Botanical Pool Journal

חמוסד למדעים ולטכנולוגיה בישראל
THE ISRAEL SCIENTIFIC PRESS

Bulletin of the Research Council of Israel

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BULLETIN OF THE RESEARCH COUNCIL OF ISRAEL

Contributors to the *Bulletin of the Research Council of Israel* should conform to the following recommendations of the editors of this journal in preparing manuscripts for the press.

Contributions must be original and should not have been published previously. When a paper has been accepted for publication, the author(s) may not publish it elsewhere unless permission is received from the Editor of this journal.

Papers may be submitted in the following languages: English, French and Russian.

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General

Papers should be written as concisely as possible. MSS should be typewritten on one side only and double-spaced, with side margins not less than 2.5 cm wide. Pages, including those containing illustrations, should be numbered.

The Editor reserves the right to return a MS to the author for retyping or any alterations. Authors should retain copies of their MS.

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Spelling should be based on the Oxford Dictionary and should be consistent throughout the paper. Geographic and proper names in particular should be checked for approved forms of spelling or transliteration.

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The following notation should be used:

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References are to be cited in the text by the author's name and date of publication in parenthesis, e. g., (Taylor 1932). If the author's name is already mentioned in the text, then just the year appears in the parenthesis, e.g. . . . found by Taylor (1932)... The references are to be arranged in alphabetical order and the following form should be used:

3. TAYLOR, G. I., 1932, *Proc. R. Soc.* London, A138, 41.

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4. JACKSON, F., 1930, *Thermodynamics*, 4th ed., Wiley, New York.

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יוצא לאור ע"י

חמוסד לפרסומים במדעי חטבע ובטכנולוגיה

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SOME INVESTIGATIONS ON THE EFFECT OF PRESSURE ON THE LUMINESCENCE OF SOLIDS. I.

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INTRODUCTION

Several workers have investigated the effect of pressure on the luminescence of solids. Very early work (Kuppenheim 1923) already showed that hydrostatic pressure had no effect on phosphors, while grinding or strong mechanical pressure (i.e. pressure in one direction) reduce the subsequent luminescent efficiency. In a more recent work (Broser and Reichardt 1953), the exact properties of a ZnS : Cu phosphor partly destroyed by grinding were investigated, and it was shown that the grinding produces new deep electron traps providing nonradiative electron transition possibilities*.

The only measurement on luminescent efficiency with pressure applied to the phosphor during luminescence was reported by Reinsch and Drickamer (1952). These authors found a reduction of about 15% in counting efficiency of cadmium tungstate crystals by pressure of 10,000 kg/cm², and tried to explain it by a shift in the emission spectrum. They did not find any similar effect in anthracene crystals.

During an investigation on the effect of pressure on the sensitivity of photographic emulsions, it was found by the author (Braun 1952) that mechanical pressure had a lasting effect in lowering the low temperature fluorescent efficiency of the emulsion without any change in the emission spectrum.

The present investigation deals with possible effects of pressure applied during luminescence on impurity activated phosphors and compares them with some further measurements on the effect of pressure on the edge emission of photographic emulsions.

EXPERIMENTAL RESULTS

1) Small glass screens with the R.C.A. phosphor powders ZnS : Ag or ZnS : Cu were introduced into a pressure chamber provided with a quartz window, and excited by ultra violet radiation. They were kept a) in air at normal pressure, b) in oxygen at normal pressure, c) in oxygen at pressures up to 150 kg/cm². No changes in emission spectra or intensities were detectable in any of the three mentioned cases in any of the phosphors.

2) Samples of the same phosphors were applied onto metal plates and pressed by a mechanical press against a quartz window. Pressures up to 500 kg/cm² could be applied. Differences of about 7% in emission intensity were found between phosphors pressed by 500 kg/cm² and the same phosphors not pressed. In a following experiment

* See also Part II of this paper.

Received August 10, 1954.

it was shown, however, that most of this decrease could be accounted for by a change in the scattering properties of the phosphor powder under pressure rather than by a change in the luminescence efficiency. This was established by measuring the reflection properties of the phosphor under pressure. A net effect of about 2% luminescent efficiency reduction (without change in emission spectra) by mechanical pressure of 500 kg/cm² seems, however, probable. The accuracy of the measurements does not allow any rigorous conclusions to be drawn, although the measurements were repeated many times and were quite reproducible.

3) An Ilford Industrial X-ray film was pressed under a hydraulic press with pressures up to 4,000 kg/cm². Some of the samples were covered with aluminium foil in order to avoid exposure to light before or during the pressing. This, however, had no effect on the results. The luminescent efficiencies of the pressed films were compared with those of the unpressed film. The films were put on a holder, immersed in liquid air, illuminated with 3600 A and their brightness was measured. If we call A the intensity of the fluorescent light of the unpressed film and ΔA its reduction by pressure p, then we obtain the plot of $\Delta A/A$ against p as shown in Figure 1.

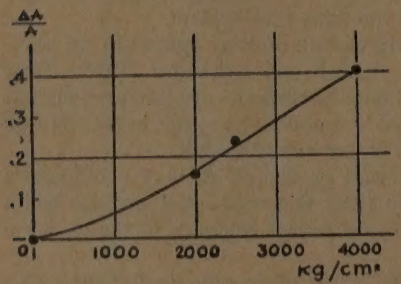

Figure 1

Relative reduction of fluorescent light intensity for a photographic emulsion, plotted against pressure.

It was tried to obtain results on the dependence of the low temperature luminescence of photographic emulsions on pressure *during* the pressing. The experimental difficulties, however, have been found unsurmountable at the present moment.

DISCUSSION

Impurity activated phosphors are only very slightly sensitive to pressure, even if it is applied during luminescence. All reported large reductions of luminescent efficiency seem to be inevitably accompanied with breaking up of the crystals.

Contrary to the nonsensitivity of those phosphors, even the small plastic deformations of the silver bromide crystals in the photographic emulsion gave rise to a considerable reduction in luminescent efficiency with no breaking of the crystals detectable (Braun 1952).

This seems further proof of the fact that the process of luminescence in impurity activated phosphors takes place in well defined centres which are not very sensitive to small changes in the surrounding lattice. The edge emission process, on the other hand, takes place at normal crystal lattice sites and is therefore sensitive. It is probable that the reduction of efficiency of edge emission is a process similar to that of temperature quenching (Farnell and Burton 1951).

The author wishes to thank Dr. E. Alexander for his constant interest and help in this work.

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SOME INVESTIGATIONS ON THE EFFECT OF PRESSURE ON THE LUMINESCENCE OF SOLIDS. II.

E. A. Braun and A. Barouch
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INTRODUCTION

The exact properties of a reground ZnS : Cu phosphor powder were investigated recently by Broser and Reichardt (1953). In the present paper, an extension of this work on other phosphors is undertaken and somewhat different results are described.

It has been well known for a long time (Kuppenheim 1923), that grinding of finished phosphor powders destroys their luminescent efficiency. Broser and Reichardt proposed, on the basis of their careful experiments, that the grinding introduces new trapping states providing non-radiative electron transition possibilities. They showed these new traps (or at least part of them) in the difference between glow curves of ground and unground phosphors.

EXPERIMENTAL PROCEDURE

In the present work, three R.C.A. phosphor powders — ZnS : Cu, ZnS : Ag, 80ZnS,20CdS : Ag — were ground for ten minutes in an electrical mill. Their luminescent efficiencies were compared with those of the unground powders on a Beckman D.U. quartz spectrophotometer.

The phosphors were then excited by 3600 A at 160°K, and the glow curves of each pair plotted by measuring their light output in the temperature range from 160°K to 500°K with the aid of the apparatus shown in Figure 1. The phosphor powder was applied on a metal disk and put into the sample holder shown separately in Figure 2.

The photomultiplier could be connected to an amplifier and recorder, thereby recording the glow curves automatically. Most of the work was done, however, by reading the output on a galvanometer.

The measurement was carried out in the following way. The sample holder was dipped into the Dewar flask, and the filtered mercury lamp turned on after thermal equilibrium had been attained. During the excitement of the phosphor, liquid air was constantly added to the flask in order to keep the temperature at 160°K. After exciting for fifteen minutes, the lamp was turned off, the flask raised until the sample holder reached the multiplier, and the emission intensity at 160°K measured. The flask was then lowered and the sample holder heated at the average rate of 30°C/sec. The emission intensity and temperature of the phosphor were simultaneously measured on two galvanometers.

RESULTS

The glow curves obtained for the various ground and unground phosphors, together with the difference curves, are shown in Figures 3 to 5. The ordinate units are not the same in both types of curves and were so chosen as to make the principal peak identical in both curves of each figure.

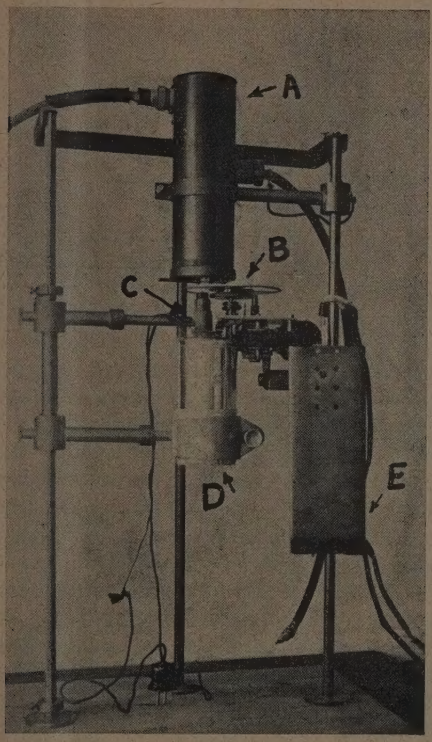


Figure 1
Apparatus for measurement of glow curves.
A — photomultiplier, B — rotating sector, C — sample holder, D — Dewar flask, E — mercury arc lamp.

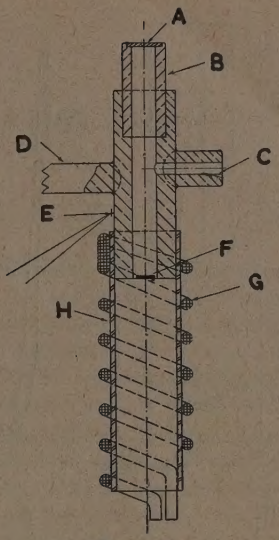


Figure 2
Sample holder
A — glass window, B — pertinax cylinder, C — to the vacuum-pump, D — handle, E — thermocouple junction, F — phosphor, G — heating wire, H — body.

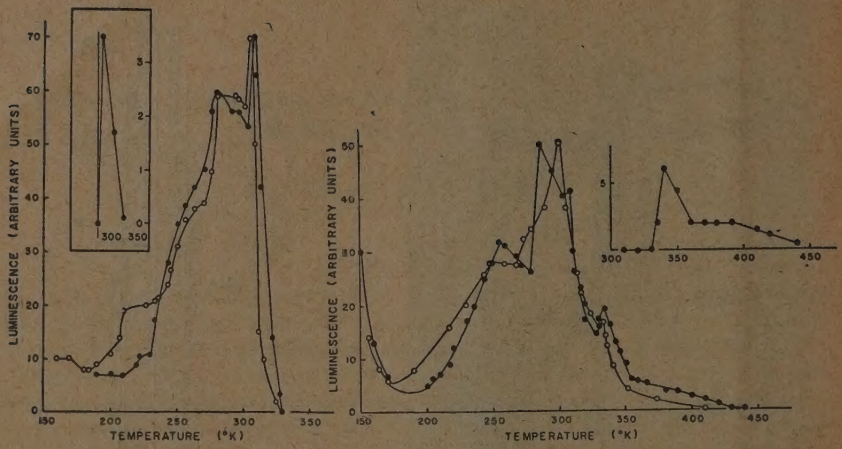
The relative light output of the ground and unground samples, as measured on screens of equal thickness with equal excitation, is given in Table I.

TABLE I

Phosphor	*ZnS : Ag*	*ZnS : Cu*	*80ZnS,20CdS : Ag*
Luminescence of the ground sample	35	10	20
Luminescence of the normal sample	100	100	100

No corrections were made for different scattering of the ground and unground powder, so that the results of Table I give no accurate measure of the relative luminescent efficiencies.

Before discussing the glow curves obtained, it should be noted that the part of the curve preceding the main peak is not very reproducible, being dependent on many factors, such as initial temperature, rate of heating, etc. On the other hand, the position of the main peak on the curve is very stable, and the curve after it is identical in all the cases measured. Taking this into consideration, two grinding effects on the glow curves are apparent from Figures 3 to 5:



Figures 3—4
Glow curves of ZnS-Ag phosphors;
—o—o—o— unground phosphor
—·—·—·— ground phosphor
Upper curve — difference of the glow curves of the ground and unground samples.

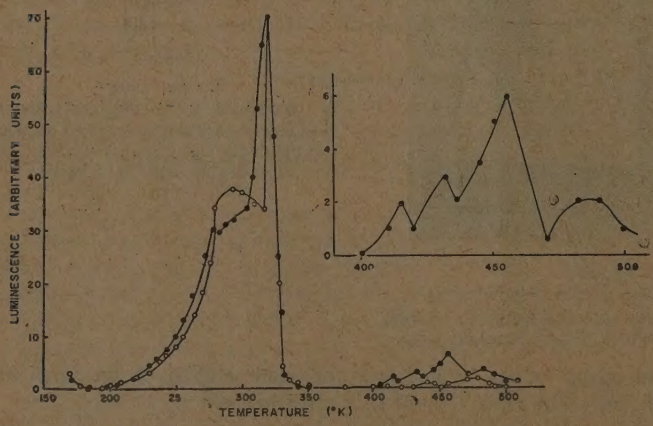


Figure 5
Glow curves of 80ZnS, 20 CdS-Ag phosphors:
—o—o—o— unground phosphor
—·—·—·— ground phosphor
Upper curve — difference of the glow curves of the ground and unground samples.

1) The displacement of some of the main maxima.
2) The appearance of new peaks at high temperatures.

The appearance of new peaks, i.e. deep electron traps introduced by the grinding, is in agreement qualitatively with former results on ZnS : Cu (Broser and Reichardt 1953). The effect is, however, much less marked and might be explained by a redistribution of traps as well. The displacement of the main peak appearing in some of the curves was not reported hitherto and could be explained on one assumption only: that the whole phosphorescence process, with ultraviolet excitation, is strongly dominated by the surface of the phosphor.

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1. Broser, I. and Reichardt, W., 1953, *Z. Phys.*, **134**, 222.
2. Kuppenheim, H., 1923, *Ann. d. Phys.*, **70**, 113.

MUCOIDS AND THEIR BIOLOGICAL FUNCTIONS*

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There is as yet no clear cut definition of the term "Mucoid" and perhaps the best approach to an appreciation of its meaning is to give a rough idea of the concept — which is still in the process of development — as it has emerged in slow stages. Early in the century many substances with a slimy, mucinous consistency, i.e. having a high viscosity, were subjected to the usual fractionizing procedures, and the partially purified materials were investigated by the contemporary analytical methods. Most of these substances have thereby been identified as polymolecular complexes containing amino acids, sugars and hexosamines. Most of the original work was done on tissue fluids and various animal slimes. The state of knowledge up to 1925 has been ably reviewed by Levene in his classical monograph "Hexosamines and Mucoproteins".

The next stage in the progress of mucopolysaccharide chemistry arose from a study of the polysaccharides making up the capsular material of bacteria. This work was stimulated by many observations which established that it is the virulent strains of the pathogenic bacteria that are encapsulated and moreover that the immunity of the host organism is specifically directed against this capsular material. As a result, the next 15 years saw an extensive investigation into the chemistry and immunology of the bacterial antigenic polysaccharides, many of which were found to contain hexosamine as a major component. Work on these compounds has recently abated, owing not only to the realization of the complexity of the molecules involved and the limitations of our present techniques for their examination, but also to the spectacular advances of chemotherapy and antibiotics which offer a more rapid and immediate remedy to infections than does immunization.

Parallel with the general development within the field there arose a profuse and indiscriminate nomenclature identifying these complex compounds as: mucoids, mucins, mucopolysaccharides, mucoproteins, glycoproteins and glycoids. Meyer in 1938 attempted a systematization which became the basis of his subsequent classification in 1945. In his classification Meyer included only hexosamine containing compounds. Stacey in 1943 considered that Meyer's classification did not go far enough and suggested a system which included many other complex carbohydrates. This classification was slightly modified and brought up to date in his later review in 1946. In both systems the basis of classification is chemical, depending on the constituents present in the individual mucopolysaccharides.

Without entering into the polemics of nomenclature and discussing what constitutes a better basis for classification (the physical property, such as being slimy and having a high viscosity, or the possession of a common chemical component such as the hexos-

* Substance of a lecture delivered before the Israel Chemical Association at a Symposium held in December 1952.

amines), and though appreciating the reluctance of Stacey to limit the classification to hexosamine containing compounds alone (seeing that it does, for instance, divide the bacterial polysaccharides into two groups; those which do and those which do not contain hexosamines), many feel that Meyer's suggestion has more to recommend it. Moreover the term "Mucoid" would appear to be the most suitable general group heading for this class of compounds, with the main subdivisions as follows:

1. Mucosaccharides: simple low molecular weight compounds containing hexosamine; naturally occurring, or partial degradation products of the macromolecular complexes. E.g. streptomycin (Lemieux and Wolfrom 1948) and uridine diphosphate acetylglucosamine (Cabib, Leloir and Cardini 1953).
2. Mucopolysaccharides: Macromolecular complexes of predominantly carbohydrate composition, but may contain up to 25% of amino acids or other constituents. E.g. hyaluronic acid (Meyer 1947) and blood group substances (Morgan 1947, Bray and Stacey 1949).
3. Mucoproteins: Macromolecular complexes of predominantly proteinous components (up to 75%). E.g. gonadotropic hormone (Li 1949).
4. Mucolipids: Macromolecular complexes predominantly of lipoidal nature. E.g. globosides (Yamakawa and Suzuki 1952), strandin (Folch, Arsove and Meath 1951, Westphal and Luederitz 1954).
5. Muconucleotides: Macromolecular complexes containing nucleotide residues (Utusi 1949).
6. Sialomucoids: Macromolecular complexes containing besides hexosamine the as yet uncharacterized residue which gives a direct colour reaction with Ehrlich's reagent and a pink colour in the Bial test, and provisionally known as sialic acid (Blix 1940 and Aminoff 1955). E.g. salivary mucoid (Blix *et al.* 1935, 1936), gangliosides (Klenk 1942), hematosides (Yamakawa and Suzuki 1953).

CLASSIFICATION OF MUCOIDS ACCORDING TO THEIR BIOLOGICAL FUNCTIONS

Up to 1925 most of the mucopolysaccharides and mucoproteins studied had been, biologically speaking, inert. Now many hexosamine containing compounds have been found to have not only a recognizable passive (e.g. the structural polysaccharides such as hyaluronic acid) but also in some cases a very specific biological activity as antibiotics, enzymes, hormones and as virulence determining factors.

According to their biological activity most substances belong to one or more of the following categories: structural, storage, secretory, and those with specific biological activity. It is not intended here to give a detailed and systematic account of such substances as it would be too long and would add but little to the already existing comprehensive reviews of Meyer (1938, 1945, 1947) and Stacey (1943, 1946). Only a few examples will be chosen; not on account of their individuality but rather as members of a group exemplifying a biological concept.

1. *Structurally active mucoids*

What are the essentials of a structurally active substance? It will be agreed that chemical resistance, physical rigidity without loss of elasticity and pliability, coupled with the ability to serve as a selectively permeable barrier, are the characteristics that

make for an efficient structurally active substance. As such, chitin (poly-*N*-acetylglucosamine) serves the same admirable purpose in insects, crustacea and fungi as does cellulose in plants. A somewhat related property is the function of hyaluronic acid as the connective tissue of skin dermis, and chondroitin sulphate as the matrix for cartilage and bony structures. In yet another example the physical properties of the mucoids, viz. transparency, high refractive index and elasticity, have been exploited in the vitreous and aqueous humour of a structurally functional unit, the eye (Meyer 1947).

In the examples quoted we have dealt with structural functions of extra-cellular products in higher animals. In like manner some bacterial polysaccharides making up the cell wall in bacteria, as the capsular material in Gram-positive and Gram-negative organisms and the waxy covering of the acid-fast bacteria, are also composed of mucoids; in the former predominantly mucopolysaccharides and mucoproteins whilst in the latter mucolipids (Landsteiner 1946, Evans and Hibbert 1946, Burger 1950).

Whilst the capsular material can be regarded as an extra-cellular structure, the unicellular microorganisms as the individual cells of tissues of higher organisms are bounded by a definite membrane. This membrane, in order to preserve its identity, likewise has to be chemically resistant, physically rigid, an effective barrier and yet showing selective permeability. Until recently, the cellular membranes of animal cells were presumed to be protein-lipid complexes (Parpart and Dziemian 1940, Ponder 1948) but now more and more evidence is forthcoming to demonstrate the presence of mucoidal components as well.

Unlike the extracellular structurally active mucoids which are found in large amounts, the presence of the mucoids in the deliminating membranes had not been suspected, and has only been demonstrated owing to the availability of sensitive biological tools. Thus the somatic antigens of bacteria and the blood group factors of erythrocyte stroma have been shown to be surface structures by the sensitive serological techniques (Landsteiner 1946), whilst the presence of other mucoids in the cell membrane has been demonstrated accidentally in the investigations on the course of lysis of bacteria by bacteriophage (Delbrueck 1942, Craigie 1946, Dubos 1945) and infection of host cells by the mumps-influenza group of viruses (Burnet 1951). The results of these experiments not only demonstrated the presence of the mucoids as integral components of the cellular membrane but also as important sites of entry for the parasite; the mucoids thus constitute specific receptors for the given pathogen. Active disruption of these receptors by the phage or virus permits the entry of the pathogen without loss of the intercellular components of the host cell (lysis of the cell only occurring at a later stage, after the multiplication of the virus particles). Destruction of these receptors, e.g. of RBC, by other means, viz. enzymatically by trypsin and by RDE (Receptor Destroying Enzyme) of the influenza-mumps group of viruses, of *V. cholera* and *Cl. Welchii* (Burnet, McCrea and Stone 1946), or oxidation with periodate (Hirst 1948), likewise results in no lysis or haemolysis. However, there are other mucoidal components in the cell surface, destruction of which results in partial or complete breakdown of membrane permeability as manifested by e.g. immediate haemolysis. Whilst the receptors, destruction of which is not accompanied by immediate lysis, are predominantly mucopolysaccharides (e.g. blood group factors), mucoproteins or sialomucoids (e.g. influenza virus receptors on RBC), those associated with immediate lysis are mucolipids (Forssmann and Wasserman antigens).

2. *Mucoids as storage products*

Too little is known of the metabolism of mucoids to assign the term storage mucoid to any of the substances with which we are acquainted. Unlike the carbohydrate storage products such as starch and glycogen or the lipoidal oils and fats, there is no established case of a mucoid serving unequivocally as a storage product. However, it is very tempting to ascribe some such function to the mucoids of egg white (α and β ovomucoids — Meyer 1945) and the spawn covering of frog and toad eggs (Hiyama 1949, Folkes, Grant and Jones 1950).

3. *The secretory mucoids*

Coming now to the next category of substances we find many mucoids serving no other apparent purpose than the lubrication of a) joints at the interface of two rigid structures such as bones, and b) the lumen of tubes, ducts and glands such as in the respiratory and intestinal systems. Here the necessity is for a highly viscous but nonetheless continuously flowing material. As well as their active lubricating activity, these secretions also offer a definite active and passive protection to the surface of the membrane. Thus without elaborating we might mention mucoitin sulphate as an important constituent of gastric mucin, the salivary mucin secreted by salivary glands, the mucins of the respiratory tract and oviducts, etc. With the exception of mucoitin sulphate (Levene 1925, Stacey 1946), these mucins have had but little attention and their nature has not been established (see Werner 1953). This no doubt will soon be rectified, as it is becoming increasingly more obvious that the integrity of these coverings is an essential effective barrier to respiratory infection (Burnet 1951) and gastrointestinal ulceration (Wang, Grant, Janowitz and Grossman 1950). Nevertheless the evidence at hand is sufficient to indicate that these mucins are predominantly mucoproteins or sialomucoids (Werner 1953).

In this category one might also include the serum mucoproteins and sialomucoids (variously known as seromucoid, seroglycoid, globoylycoid, and the carbohydrate containing serum albumins and globulins), although their exact function has not as yet been ascertained. The concentration of seromucoids in the blood is maintained remarkably constant and is physiologically regulated, so much so that fluctuations in the serum mucoids have been suggested as useful indications of certain pathological conditions (Mehl, Golden and Winzler 1949). There is, moreover, quite an extensive literature associating the concentration of serum mucoids with cancer and other malignant and benign growths (Shetlar, Foster *et al.* 1949, Homburger 1950). Some of the benign tumours, such as ovarian cyst fluids, have indeed been a rich and fruitful source of many mucoids (Levene 1925, Morgan and Van Heyningen 1944).

4. *The mucoids with specific biological activity*

This group of mucoids represents a heterogeneous collection of substances, each with its own specific biological function as: hormone, enzyme, co-enzyme, antibiotic or anticoagulant. Here, as is usually the case with most of the dynamically active biological materials, these substances work on the "trigger mechanism", only small quantities being necessary to manifest large activity. It is not surprising, therefore, that they are found only in small quantities in the organism. Their detection has only been

possible through their specific biological activity, whilst their isolation and characterization has had to await the development of suitable biological assay techniques.

As examples of mucoids functioning as hormones we have the anterior pituitary gonadotropic hormone (Li 1949) and thyrotropic hormone (Fraenkel-Conrat *et al.* 1940), whilst the enzymes, cholinesterase (Bader, Schuetz and Stacey 1944) and alkaline phosphor-esterase from some sources (Leach 1947, Burnet 1948) have also been shown to be mucoproteins (however see also Day 1949). Heparin, the active anticoagulant constituent of blood, has been identified histologically in many organs and has been successfully isolated from liver and lungs (Jorpes 1946). As representatives of antibiotics we have streptomycin (Lemieux and Wolfrom 1948), and in passing it might also be recalled that treatment of *St. aureus* with penicillin results in the liberation of large quantities of a uridine derivative of a hexosamine-like substance (Park 1952), thus indicating the intimate interplay of antibiotics and mucoids. Whilst the virulence enhancing factor of gastric mucin (Olitzky 1948) has now been shown to consist of more than one factor, not all of the constituents being mucoids (Smith *et al.* 1952), the contribution of the mucoidal capsule of pathogenic bacteria to their virulence has already been thoroughly discussed (Wilson and Miles 1946, Dubos 1949).

PHYSICO-CHEMICAL PROPERTIES AND BIOLOGICAL ACTIVITY

The biological activity of a substance may be a function of the molecule as a whole or it may be due to a small active part of the molecule only. In the former case the activity might be attributable to the physical properties of the mucoid, e.g. viscosity, refractive index, rigidity and elasticity, or to a chemical characteristic of the molecule as a whole, e.g. presence of chemically resistant bonds. If, however, the activity is due to a small active moiety of the whole molecule only, the action will quite definitely be chemical and due to the presence of a specific chemical constituent or linkage.

How then is the biologically active moiety ascertained? If we are dealing with a simple homopolymolecular substance like chitin or cellulose, i.e. containing only one chemical unit, no difficulty is experienced. The problem is only to determine what is involved in the type of linkage and the chain length or branching that is essential for the manifestation of the biological activity. With the heteromolecular polymeric complexes containing several possible units and types of linkages, the problem is more difficult. The procedure is, therefore, to determine (a) the constituents present, followed by (b) structural studies and (c) ascertaining the biologically active groupings within the molecule. This may be resolved chemically by the use of reagents reacting specifically with characteristic groups (aldehydic, carboxylic, amino, alcoholic, etc.), and thereby affecting the biological activity, or by the use of specific biological systems such as enzyme/substrate and antigen/antibody cross-reactivity.

1. *Biological activity attributable to a physical property*

This is often difficult to ascertain, since seldom is loss of activity due to a loss of physical property alone. Usually a change in physical property is a reflection of some fundamental change in chemical structure. Generally one can only conclude that if a substance retains its biological activity even after a definite change in physical pro-

perty then the physical property is not essential to the biological activity. That is to say, only negative conclusions are possible.

Bearing this in mind, it would appear that the suitability of chitin as an exoskeleton depends on the presence of long rigid chains of 1-4-β-*N*-acetylglucosamine linkages (Meyer 1950) which constitute a stable configuration (cf. cellulose). If now the alternate *N*-acetylglucosamine residues in the long chain are replaced by glucuronic acid, with the carboxyl group at C 6 free, we get a polymeric electrolyte, like the pectins and and other polyuronides, capable of reacting with the basic groups of proteins or polyvalent cations to give cross-linkages in the otherwise open lattice-work. It is no doubt by virtue of this property (Katchalsky 1953) that hyaluronic acid and chondroitin sulphate form admirable supporting tissue in the dermis and matrix of cartilage and bone (Meyer 1947).

2. *Biological activity attributable to a chemical structure*

The greatest difficulty attending structural studies of the mucoids is their isolation in a pure, homogeneous state suitable for subsequent chemical investigations. The reason for this is (a) the marked lability of mucoids in general, they being readily degraded during the isolation, and (b) their usual occurrence in groups or as a family of mucoids with similar properties, which demand all the ingenuity of the latest techniques to separate them. Few of the mucoids have been isolated in crystalline form; one such example is barium heparinate, but even in this case the homogeneity of this substance is questionable, its activity being smaller than that of the corresponding amorphous compound (Jorpes 1946).

Having isolated the material and established its homogeneity by the now classical techniques of (a) sedimentation in the ultracentrifuge, (b) electrophoresis, (c) diffusion, and (d) solubility, the next step is to isolate and identify the constituents present in the complex molecule. One need hardly mention in this connection the invaluable use that has been made of the latest chromatographic, ionophoretic and counter-current methods as comprehensive micro-separative techniques. Subsequent quantitative analysis of the constituents present enables a more rational approach to be made to the structural studies that follow. These involve the usual course of partial acid, alkaline or enzymatic hydrolysis; and, the molecule having been split into its various components, carbohydrate and protein, the application of the routine techniques of the respective fields. Perhaps it would not be out of place at this juncture to point out an error too frequently overlooked. The results of the structural studies usually lead to the identification of basic "units" which are repeated several times within the molecule. These are "statistical" and not necessarily genuine "structural units".

When it is considered that in the mucoids there are many components: carbohydrate, protein, lipid, nucleotide, acetyl, sulphate and/or phosphate residues and numerous types of linkages that are theoretically possible: ester, ether, *O*-glycoside, *N*-glycoside, peptide, Schiff base, betaine (and the less likely oxazoline, oxazole and pyrrole residues), it is no wonder that so few mucoids have been sufficiently well characterized as to be represented by structural configurations. This perhaps can only be claimed for a few mucosaccharides, e.g. chondrosin (Masamune, H., Yosizawa and Maki 1951), mucosin (Isikawa 1951), streptomycin (Lemieux and Wolfrom 1948) etc., and the

simple macro-molecular mucopolysaccharides such as chitin (Meyer 1950, Jeanloz and Forchielli 1950).

In view of the many technical difficulties involved, the method of approach via structural studies is slow and rather limited and the alternative procedure is often resorted to exclusively or in conjunction with the use of:

(a) Specific chemical reagents to determine the biologically active groups as in the proteins (Herriott 1947, Olcott and Fraenkel-Conrat 1947) and the carbohydrates (Evans and Hibbert 1946, Pigmann and Goepp 1948, Bell 1949). These have all been used and have provided many valuable results.

(b) Specific enzymes known to split definite linkages have also been extensively used in elucidating the presence of certain linkages, but unfortunately in many cases the results are of doubtful value as more than one enzyme was present in the crude preparations so frequently used for the hydrolysis.

(c) Serological cross-reactions have likewise been utilized to confirm and extend results obtained by other techniques, e.g. in the case of pneumococcal Type III and VIII and Friedlaender's bacillus specific polysaccharides (Heidelberger and Hobby 1942). It should be noted, however, that in general the enzyme/substrate interaction is more specific than the antigen/antibody system (Dubos 1949, p. 125).

Before summarizing, it should perhaps be emphasized that:

(a) More than one biological activity may be associated with a given substance.

(b) The possibility exists of more than one substance having the same biological activity, viz. cross-reactivity.

(c) Partial degradation may result in the loss of one activity, increase in a second or even the development of an entirely new property not observed in the original substance.

Thus, as an example, the blood group A substance is capable of inhibiting the agglutination of A cells by anti-A serum and also the haemolysis of sheep cells by an anti-sheep serum (a). This latter property the A-substance shares with many other mucoids from organs of certain animals and from the antigenic complex of a few bacteria, which are collectively known as Forssmann antigens (b) (Buchbinder 1935, Brunius 1936). Further, illustrating the third point (c), on mild acid hydrolysis the ability to inhibit the agglutination of A cells is progressively lost while the ability to inhibit haemolysis of sheep cells is enhanced and moreover two entirely new serological characteristics are developed, viz. the ability to cross-react with horse anti-pneumococcal Type XIV and horse anti-anthrax serum (Kabat, Baer, Bezer and Knaub 1948; Aminoff, Morgan and Watkins 1948, 1950).

In many cases data of this nature are valuable in the elucidation of structure and, in the particular example quoted, suggest that the *N*-acetylhexosamine and galactose residues common to the Forssmann antigen (Brunius 1936, Chase and Landsteiner 1939), pneumococcus Type XIV (Goebel, Beeson and Hoagland 1939) and anthrax specific *C*-polysaccharides (Ivanovics 1940), are closely associated and similarly arranged in these polysaccharides as in the acid-resistant core of the blood group A substance. The lack of reactivity of the pure undegraded blood group A substance with anti-Type XIV and anti-anthrax serum is possibly due to the masking of this "core" by the

fucose residues situated at the periphery (Aminoff, Morgan and Watkins 1950, Aminoff and Morgan 1951).

In most of the biologically active mucoids the integrity of both the carbohydrate and protein moieties appears to be essential for the manifestation of the full activity. Thus any treatment that in any way degrades the protein or carbohydrate portions of the molecule, e.g. — by partial acid, alkaline or enzymatic hydrolysis (proteolytic or carbohydrate splitting enzymes), oxidation with periodate, acetylation or deacetylation, desulphatation etc., as the case may be, results in the loss of the specific biological activity. Whereas in the majority of cases it is difficult as yet to assess the contribution of the different components to the net biological activity, in the case of the bacterial polysaccharides there is evidence that, whilst the protein fraction confers the antigenicity, it is the carbohydrate moiety that determines the specificity of the antigen (Landsteiner 1946).

SUMMARY

It is still too premature to go beyond the above general statements and to discuss the specific biological activity as a function of the physical properties or of the presence of definite chemical structures. But, nonetheless, it appears from what has been reviewed that most of the structurally active mucoids owe their activity to their physical properties, while those of the secretory and biologically dynamic systems are dependent for their activity on the integrity of some specific chemical unit or group of molecules.

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ON THE "SUDANO-DECCANIAN" ELEMENT IN THE FLORA OF PALESTINE

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In a series of recently published papers (Monod 1939, 1944; Bordes 1940; Trochain 1940; Sauvage 1946, 1949; Zohary 1947 a, b, 1950) on the plant geography of some Middle East and North African countries, the name "Sudano-Deccanian Region", first coined by Eig (1931), has been widely accepted. In this region Eig included the whole belt extending between the Saharo-Sindian and the equatorial regions, as well as the Deccanian Plateau, stressing, however, the floristic distinctness of the Indian part.

While dealing with the geography of the Arabian flora, the question has arisen whether the "Sudano-Deccanian" region and the corresponding "Sudano-Deccanian" element, as conceived by Eig (l.c.), really constitute natural plant geographical concepts. This led here to the re-examination of the geographical distribution of those of the Palestinian species referred to by Eig as Sudano-Deccanian and sub-Sudano-Deccanian, as well as of the floristic relations between the areas included by Eig within his Sudano-Deccanian region.

Interrelations between the flora of the Deccan Peninsula and that of northern extra-equatorial tropical Africa

Grisebach (1884) already stressed the lack of floristic affinity between the Sudan and the Deccan Peninsula (the western of the two Indian peninsulas, the eastern one being referred to as the Indo-China Peninsula). According to him, these two areas, due to their climatic similarity, have a physiognomically similar vegetation, but do not show any natural exchange of flora. Grisebach, therefore, separated the Deccan from the Sudan, including the former within the Indian Monsoon Region. Drude (1890) went so far as to establish a separate Indian Tropical Kingdom in which the Deccan was included. Similarly, Good (1947) considered the Indo-Malayan area as a separate subkingdom of the Palaeotropic kingdom. Diels (1936), too, by establishing his Anterior Indian Region, emphasized the autonomous floristic nature of the Deccan Peninsula. According to Hooker and Thompson (1855), there is a strong physiognomic similarity between the Indian and African vegetation. They found, however, that only few species are common to both these continents, whereas a much greater floristic affinity exists between Java and the Deccan Peninsula, especially in its mountainous parts.

The data on the Deccanian flora, recorded by Hooker et al. (1872—1897), were examined here on the above lines with the aid of other floristical works (Oliver et. al. 1868—1937; Blatter 1919—1936; Exell and Mendonça 1937, 1951; Schwartz 1939; Flore du Congo Belge, 1948). A statistical representation of the geographical distri-

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bution of the 4789 species recorded by Hooker et al. (l. c.) for the Deccan Peninsula and Ceylon is given in Table I.

TABLE I

Statistical representation of the geographical distribution of species recorded for the Deccan Peninsula + Ceylon

A = Deccan Peninsula (up to 22°N) + Ceylon; B = Sudan + S.W. Arabia; C = Indo-China Peninsula + Malay Peninsula; D = Area north of 22°N including Afghanistan, Baluchistan, Punjab, Himalaya, Assam; E = Malayan Archipelago; F = China, Philippines, Japan, Formosa; G = Tropical Africa in general.

Distribution	*Area*	*No. of species*
Endemic to	A	2652
Exclusive only to the given combination of areas	A + B*	27
	A + C	79
	A + D	322
	A + C + D	235
	A + C + D + E	267
	A + C + D + E + F	243
	A + C + D + E + G	144
Wide		820
	Total	4789

* Slight irradiations into the adjacent regions being disregarded.

As may be seen from the above Table, out of the above-mentioned 4789 species the number of species exclusive to the area from Afghanistan to the Malay Peninsula, designated as A + C + D (with the exception of those endemic to the Deccan Peninsula and Ceylon), totals 636. Among them 79 species are confined to and shared by the two Indian Peninsulas. It is, therefore, significant that only 27 species could be considered as Sudano-Deccanian, being almost exclusive to the area regarded by Eig (l. c.) as the Sudano-Deccanian region. This low number alone is sufficient to emphasize the feeble connection between the Deccanian and the Sudanian floras.

Summing up, there seems to be no justification to unite the Deccan, the Sudan and the south-western part of the Arabian Peninsula into one plant geographical region. It is proposed, therefore, to separate the African and Arabian parts of Eig's "Sudano-Deccanian" region from the Deccan, as an independent Sudanian region. Further, it seems much more justified, on floristic as well as climatic grounds (Kendrew 1942, Haurwitz and Austin 1944) to include the Deccan Peninsula within the Indian Monsoon Region of Grisebach (1884) or the Indo-Malayan Subkingdom of Good (1947). As the exact plant geographical evaluation of the Deccan is not the subject of this paper, it will be here tentatively referred to as the Deccanian region.

Relations between the Sudanian and the Eritreo-Arabian floras

There has long been much controversy as to the plant geographical nature of northern extra-equatorial tropical Africa. Grisebach (1884) regarded the whole area as climatically and vegetationally uniform, but emphasized its comprising diverse

autonomous vegetational and floristic centres with a high percentage of endemics, i.e. Senegambia, eastern Nubia and Abyssinia. Abyssinia is outstanding in this respect by its 1200 endemics which constitute more than one third of the total endemics of the entire area (Grisebach, l. c.).

Engler (1908), Hayek (1926), Diels (1936) and Good (1947) distinguished between the western Sudanian lowland park steppe and the eastern highland region.

TABLE II

Selected genera with species endemic to the Eritreo-Arabian or to the West-Sudanian* subregion, with no endemics common to both*

(Open figures = endemic; figures in brackets = indigenous but not endemic, and not found in the alternative subregion)

Name of genus	*Species recorded ** for tropical Africa and tropical Arabia*	*Species indigenous in the Eritreo-Arabian subregion*	*Species indigenous in the West-Sudanian subregion*
Panicum	106	13 + (7)	18 + (7)
Barleria	87	24 + (10)	2 + (1)
Setaria	81	7 + (7)	4 + (4)
Clerodendron	70	5 + (0)	5 + (5)
Ocimum	56	13 + (4)	0 + (1)
Thunbergia	54	6 + (1)	3 + (1)
Heliotropium	52	24 + (10)	1 + (2)
Andropogon	47	9 + (7)	8 + (3)
Croton	45	4 + (3)	4 + (0)
Tragia	44	4 + (0)	5 + (0)
Vigna	38	8 + (0)	6 + (3)
Hibiscus	37	7 + (8)	6 + (3)
Cordia	35	5 + (4)	7 + (1)
Merremia	25	3 + (2)	2 + (0)
Conyza	21	8 + (7)	1 + (1)
Hygrophila	18	3 + (1)	6 + (0)
Eriosema	18	6 + (0)	2 + (2)
Sweertia	34	14 + (2)	—
Rhynchelytrum	32	3 + (0)	—
Trichodesma	25	13 + (3)	—
Ruellia	20	10 + (3)	—
Seddera	14	8 + (1)	—
Eragrostis	12	4 + (5)	—
Rhus	11	5 + (2)	—
Pentaschistis	11	3 + (0)	—
Sporobolus	10	3 + (3)	—
Melhania	9	5 + (1)	—
Hypericum	8	3 + (3)	—
Argyrolobium	9	7 + (1)	—
Vitex	58	—	11 + (3)
Tristachya	19	—	6 + (2)
Cola	11	—	2 + (2)
Anadelphia	9	—	5 + (1)

* See text below.

** According to Oliver, Thiselton-Dyer, Prain and Hill (1868—1937), Balfour (1887), Durand and Schinz (1898), and Schwartz (1939).

TABLE III

Selected genera with species endemic to the Eritreo-Arabian or the West-Sudanian* subregion with only few endemics common to both*

(Figures as in Table II)

Name of genus	*Species recorded * for tropical Africa and Arabia*	*Species indigenous in the Eritreo-Arabian subregion*	*Species indigenous in the West-Sudanian subregion*	*Species endemic to the Omni-Sudanian region*
Euphorbia	231	67 + (12)	7 + (2)	1
Loranthus	217	16 + (6)	9 + (5)	1
Ipomoea	155	16 + (20)	3 + (7)	3
Crotalaria	115	22 + (12)	9 + (1)	2
Indigofera	109	14 + (15)	18 + (8)	3
Pennisetum	92	24 + (10)	13 + (3)	3
Justicia	87	23 + (12)	1 + (3)	1
Vitis	78	10 + (5)	19 + (0)	2
Phyllanthus	73	4 + (4)	2 + (2)	1
Tephrosia	69	12 + (8)	9 + (2)	3
Hyparrhenia	61	17 + (3) (?)	8 + (2)	2 (?)
Brachiaria	56	13 + (4)	7 + (2)	1
Digitaria	49	4 + (2)	8 + (2)	1
Andropogon	47	9 + (7)	6 + (3)	—
Acacia	41	10 + (5)	1 + (1)	2
Grewia	38	3 + (3)	2 + (3)	2
Loudetia	36	1 + (1)	6 + (4)	1
Cassia	28	4 + (3)	1 + (0)	2
Sacciolepis	22	2 + (1)	5 + (0)	1
Aristida	18	5 + (8)	—	1
Schizachyrium	18	2	6 + (2)	2
Cymbopogon	15	5 + (2)	(?)	1
Elyonurus	11	—	6	1
Rottboellia	6	—	1	1
Rhytachne	6	—	1	1

* According to sources as in Table II.

The floristic autonomy of these two areas is also evident from the data shown in Tables II and III.

The above data show that, while there exists a very large number of species endemic to either the Eritreo-Arabian or the West-Sudanian subregion, there is an extremely small number of species endemic to both. Examination on the same lines of entire families yielded similar results.

Also Good (l. c.), when reviewing the genera endemic to various parts of tropical Africa, treated his Sudanian Region together with the West African Forest Region, and, on the other hand, the North-east African Highland and Steppe Region together with the East African Steppe Region. He thus emphasized the existence of two well-marked floras, that of western and that of eastern tropical Africa.

Thus for floristic as well as geologic (Gregory 1920) reasons it seems justified to keep apart the two parts of the Sudanian region. For the time being, it is proposed to sub-

divide this region into two subregions: one, the West-Sudanian subregion, corresponding to the Sudanian lowlands; the second, the Eritreo-Arabian subregion, comprising the south-western part of the Arabian Peninsula, the African Red Sea coast, Eritrea, Somali, Northern Abyssinia and Socotra. The name "Eritreo-Arabian", coined by Reichert (1921) and used here in a wider sense than originally proposed, is to be preferred to that of Engler (1908) and Good (1947), i.e. the "North-east African Highland and Steppe". This is especially so, since Abyssinia, of which the last-mentioned name is particularly suggestive, is not floristically homogeneous (Schweinfurth 1891, Engler 1910, Hedberg 1951, Scott 1952), and its southern part is to be included rather in the East African Highland and Steppe Region of Good (1947).

The Eritreo-Arabian subregion is designated by its very high number of endemic species, and about fifty endemic, mostly oligo- or monotypic, genera, half of which are confined to Socotra (Good 1947). It is also characterized by strong development of some families, e.g. *Acanthaceae*, *Asclepiadaceae*, *Borraginaceae*, *Burseraceae*, *Capparidaceae*, *Convolvulaceae*, *Labiatae*, *Rubiaceae*, *Scrophulariaceae*, and of some genera, e.g. *Adenium*, *Aloë*, *Euphorbia*, *Helichrysum*, *Senecio* of the *Kleinia* section, etc. (Balfour 1887).

The Sudanian element in Palestine

In accordance with the above conclusions, the distribution of the thirty-eight species, indigenous in Palestine, and referred to by Eig (1931—32) as Sudano-Deccanian and sub-Sudano-Deccanian, was reexamined with the aid of the above cited as well as other floristic works (Andrews 1950, 1952). The data obtained and the proposed reclassification of these species are given in Table IV.

As shown in Table IV, the majority of the monoregional Palestinian species, assigned by Eig (l. c.) to the Sudano-Deccanian element, are Eritreo-Arabian or sub-Eritreo-Arabian species (29%; this and the subsequent percentages are based on the 38 above-mentioned species taken as 100%). Second in number is the Omni- and sub-Omni-Sudanian group (23.7%). One species (2.6%) should be considered as sub-South African Transitional, and may be a relic of the desert element in the sense of Gilliland (1950), extending from Kalahari to the Red Sea coast and Southern Palestine*. Two species (5.3%) are common to the Sudanian and the Deccanian regions, and one (2.6%) to the Sudanian and the East African Steppical regions. The remainder (14 species = 36.8%) are distributed over several tropical regions, and should not be considered Sudanian or Sudano-Deccanian. *Ficus Sycomorus*, also listed in this category, was not considered as not indigenous in Palestine.

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My sincerest thanks are due to Prof. M. Zohary for suggesting this study and guiding me throughout, and to Dr. Naomi Feinbrun for reading and suggesting changes in the manuscript.

* Since, according to J. T. Henrard (A monograph of the genus *Aristida*, 1929-32), *Aristida Sieberiana* is found only in Southern Palestine, the data found on the distribution of this species, though seeming authentic, need confirmation by some authority on African grasses.

TABLE IV

*Geographical distribution of the Sudanian species occurring in Palestine**

Name of species	Element or plant geographical group	Distribution: Cap Verde	Senegal, Gambia	French Sudan	Nigeria	Chad, North Central Darfur	Equatoria	Kordofan, Sennaar, Fung	Nubia, Red Sea Coast	Eritrea	Abyssinia	Somali	Socotra	S. W. Arabia	Countries of the Gulf of Guinea Coast	Cameroons	Congo	Angola	Uganda, Kenya, Tanganyika	Mozambique, Rhodesia	Damaraland, Namaqualand	S. Africa	N. Africa, Sahara, Sinai	Syria	Persia, Afghanistan, Baluchistan	Sind	Punjab	Himalaya, Bengal, Assam	Deccan Peninsula	Ceylon	Indo-China Peninsula	Malayan Archipelago	Australia, America
nni-Sudanian																																	
Acacia laeta R.Br.	S			X				X	X	X	X			X									X										
b-Omni-Sudanian																																	
Trianthema pentandrum L.	sS (SS)		X			X		X	X	X			X	X	X								X		X	X	X						
Maerua crassifolia Forsk.	sS (SS)		X		X	X		X	X				X	X									X		X								
Acacia tortilis Hayne (=*A. raddiana* Savi)	sS (SS)		X	X					X					X									X										
Balanites aegyptiaca Del.	sS (SS)				X	X		X	X	X	X			X					X				X										
Zizyphus spina christi (L.) Willd.	sS (SS)		X		X	X		X	X	X	X	X	X	X									X	X	X								
Pentatropis spiralis (Forsk.) Decne.	sS (SS)		X						X	X	X	X		X											X	X	X						
Leptadenia pyrotechnica (Forsk.) Decne.	sS (SS)		X			X		X	X			X		X						X			X		X	X	X						
Acacia seyal Del.	sS (EAS)		X			X		X	X		X									X			X		X								
itreo-Arabian																																	
Moringa aptera Gaertn.	EA							X	X	X	X	X		X									X	X	X								
b-Eritreo-Arabian																																	
Indigofera argentea L.	sEA (SS)						X	X	X	X	X		X	X									X		X	X							
Tephrosia Apollinea (Del.) DC.	sEA (SS)							X	X			X	X	X									X		X								
Solenostemma argel (Del.) Hayne	sEA (SS)							X	X														X										
Oxystelma alpini Dec.	sEA (SS)							X	X		X												X										
Acacia spirocarpa Hochst.	sEA (EAS)							X	X	X	X			X						X			X	**									
Glossonema boveanum Decne.	sEA (EAS)								X	X	X		X	X									X	**									
Loranthus acaciae Zucc.	sEA (EAS, SS)						X		X	X	X			X																			
Capparis galeata Fres.	sEA (EAS, SS)								X	X		X	X	X					X	X			X			X	X						
Tripteris vaillantii Decne.	sEA (EAS, SS)								X			X	X						X				X			X							
Cocculus pendulus (Forsk.) Diels	sEA (D, SS)	X	X		X	X		X	X	X	X	X		X	X				X				X			X	X	X		X			
b-South African Transitional																																	
Aristida sieberiana Trin.	sSAT (EA, W-SS, M)								X													X											
-regionals: Sudanian-Deccanian																																	
Capparis decidua (Forsk.) Edgew.	sS—D (SS)					X			X	X		X	X	X									X			X	X	X		X			
Abutilon muticum (Del.) Webb	sS—D (SS)	X	X						X	X		X		X	X					X			X			X	X			X	X		
-regionals: Sudanian—East African Steppical																																	
Acacia albida Del.	S—EAS		X				X	X	X	X		X			X					X			X										
uri-regionals: Tropical African																																	
Euphorbia aegyptiaca Boiss.	TA	X	X		X	X			X	X		X	X		X	X	X						X	X									
Zygophyllum simplex L.	sTA (SS)	X							X	X			X	X				X	X			X	X			X	X	X					
Solanum incanum L.	sTA (E-SS)				X		X		X	X	X	X	X					X		X		X	X	X	X	X	X	X					
Pluchea dioscoridis (L.) DC.	sTA (SS, M)								X			X		X		X	X	X	X	X		X	X	X	X								
uri-reg.: Tropical African—Indo-Malayan																			X														
Chrozophora plicata (Vahl) A. Juss.	TA—IM		X		X	X		X	X	X	X	X	X		X					X		X	X				X	X	X	X	X		
Cordia gharaf Forsk.	TA—IM		X		X	X			X	X	X		X	X				X		X			X			X	X		X				
Indigofera paucifolia Del.	sTA—IM (SS)		X			X			X	X		X	X					X	X	X			X		X	X		X	X	X		X	
Salvadora persica Garcin.	sTA—IM (SS)		X			X			X	X	X	X	X					X		X	X		X	X	X	X	X	X	X	X			
Abutilon fruticosum Guill. et Pers.	sTA—IM (SS)		X						X	X	X	X		X					X		X		X			X						X	
Hibiscus ovalifolius Vahl	sTA—IM (SS)		X						X	X		X		X			X	X	X		X	X	X			X			X	X			
Calotropis procera (Willd.) R.Br.	sTA—IM (SS)	X	X						X	X	X	X			X	X		X		X			X		X	X	X		X		X		
opical wides																			X														
Boerhavia repens L.	TW		X		X	X			X	X	X	X	X	X	X			X		X		X	X		X		X	X	X	X	X		X
Ipomoea palmata Forsk.	TW		X						X	X	X	X	X		X	X	X	X	X	X	X	X	X					X	X	X			X
Momordica balsamina L.	TW	X	X							X		X	X						X			X	X		X	X	X					X	X

* Abbreviations used: D = Deccanian, EA = Eritreo-Arabian, EAS = East African Steppical, IM = Indo-Malayan, M = Mediterranean, S = Omni-Sudanian, SAT = South African Transitional, SS = Saharo-Sindian (E-SS = East-Saharo-Sindian and W-SS = West-Saharo-Sindian), TA = Tropical African, TW = Tropical wides. (The names are mainly according to Good, 1947. The non-tropical distribution has not been fully represented in the Table as not relevant here).

** Upper Egypt only.

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AN ARID ECOTYPE OF *DACTYLIS GLOMERATA* L. (ORCHARD GRASS) FOUND IN THE NEGEV (ISRAEL)

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On January 23rd, 1951, *Dactylis glomerata* L. was found in a small side-wadi of Wadi Migrah, close to the northwestern edge of the Central Negev Mountains, about 25 km south of Beersheba (Figure 1,A), at 480 m above sea level. The wadi cuts into soft Senonian limestone which is overlaid with hard Campanian flint, so that it has an upper margin of flint banks and soft limestone slopes below.

Dactylis glomerata L. was found at the head of the wadi on the slopes, along the foot of a 30 cm high flint bank in a strip approximately 4 m long and 30 cm wide, and in the wadi bed itself as clumps (Figures 2, 3).

The high aridity of this area where *Dactylis glomerata* L. was found was in striking contrast with the normal habitat of the plant. Since this was apparently an exceptionally drought resistant ecotype of a generally important pasture plant, it seemed of particular interest to make exact ecological records and collect seeds, for these might prove to be important for the pasture regions of arid zones.

GEOGRAPHICAL DISTRIBUTION

Dactylis glomerata L. has its distribution centre in the humid temperate zone of Europe. It is there one of the most frequent species on meadows and in forest clearings, and it reaches up to the dwarf-pine regions of the Alps. This behaviour with respect to vertical distribution corresponds to its extension into the North.

As an indigenous species it reaches (probably with various ecotypes) far above the climatic borders of its centre, not only northwards (introduced and established even above the polar circle in Abisko, in Swedish Lapland), but even into the whole Mediterranean area and into the more humid parts of the Aralo-Caspian area, Turkestan, Transcaucasia, to Mesopotamia, and Persia.

In the Mediterranean and in the more arid border areas of its natural distribution the species seems to occur mainly as a (morphological) variety *hispanica* Boiss.

The species was introduced in nearly all temperate zones as one of the most important fodder grasses. Seeds are obtained mainly from humid areas, Sweden, Denmark and New Zealand.

This is the first confirmed discovery of the species in the area of Sinai and the neighbouring Negev. *Dactylis glomerata* L. was mentioned from Sinai by Drar and Taeckholm (1941), but with a question mark.

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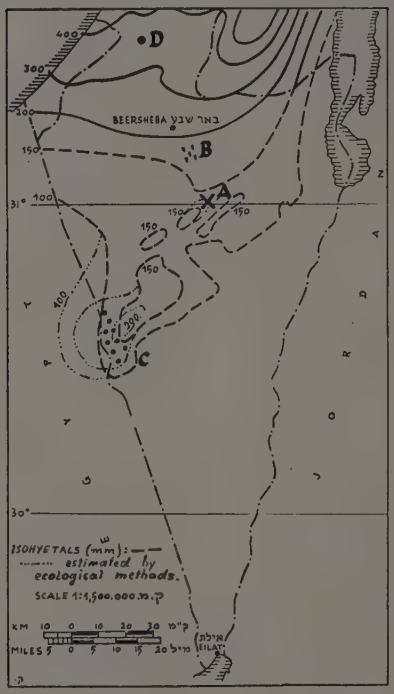

Figure 1
Map of stands of *Dactylis glomerata* L. Rainfall map by courtesy of the Meteorological Service with ecologically estimated additions.

Figure 2
Strip of *Dactylis glomerata* L. on the slopes of Wadi Migra (between the two men). Notice surrounding desert vegetation.

Figure 3
Detail of Figure 2 (One bunch of *Dactylis glomerata L.*).

PLANT-SOCIOLOGICAL RECORDS

The following describes the habitat in which *Dactylis glomerata* L. was found.

Squares Nos. 1, 2 *and* 3

Squares Nos. 1, 2 and 3 are on typical slopes outside the wadi, and show the typical vegetation of this region (Boyko 1949).

Squares Nos. 1 and 3 are approximately 20 m apart, and all factors, except inclination, and consequently insolation, are equal. Whereas on the cooler, northern slope there is an *Artemisia herba alba* community, on flat ground, with higher insolation, *Artemisia* has given way to *Zygophyllum dumosum* Boiss. This stage of transition, from steppe region, indicated by *Artemisia*, to that of stony desert slopes indicated by *Zygophyllum*, at nearly the same spot and with only a relatively small difference in the IE (Insolation-Exposure) factor (Boyko 1947), shows clearly that we are at the actual border between the steppe (Irano-Turanian in the sense of Boyko 1954) region and the desert (Saharo-Sindic) region (Eig 1931). Considering the special soil conditions of the place (mostly soft limestone with flint), the mean annual rainfall cannot possibly much exceed 150mm (Boyko 1953). On the other hand, it cannot be much less, considering that *Artemisia* occurs here already outside the water courses on northern slopes with a slight inclination only, namely 5 degrees (Boyko 1952 a).

The character of this vegetation can be seen from the squares. At present small shrubs dominate and are interspaced with a few hemicryptophytes, mostly perennial grasses. The climax of this region consists of two different plant associations: a sparse feather-grass steppe on northern slopes with lower insolation, and semi-sedert shrubs (mainly chamaephytes) dominating in flat places and southern exposures with high insolation. The tuft-building feather-grasses have been greatly repressed by extreme overgrazing, primarily to the advantage of *Artemisia herba alba*, which is apparently not eaten here by any kind of stock (Boyko 1950, 1952 b).

Record No. 4

This area is at the bottom of the wadi. A strip 20 m in length (in the direction of the flow of the wadi) and 5 m wide was marked and measured. The wadi here is between 10 and 20 m wide and about 2 to 5 m deep. It runs in a northwesterly direction. *Dactylis glomerata* L. appears at its bottom and under a 30 cm high flint bank on the slope with northeastern exposure.

This strip shows a vegetation very different from the previous ones. The plants here have the benefit of additional run-off water which collects and flows in the wadi for a few hours after every big rainfall during the rainy season. The mixture of Mediterranean species (about 45%) with Irano-Turanian (about 40%) and Saharo-Sindic (about 15%) shows that we see here a smaller section of that transitional vegetation zone which borders the Mediterranean region on its arid side. There are only 45% of Mediterranean plants left, and even they are predominantly East Mediterranean or transitional species; there is already 55% of steppe and half-desert vegetation. This is the extreme arid type of Mediterranean Batha (low scrub formation), a fragment of *Poterietum spinosi orientale*.

An analogy to this type of vegetation in its optimum, not dependent upon additional run-off water, can be found on the eastern slopes of the Central Judea mountain region. It is the "Marginal Batha", occupying approximately the 400 to 300 mm rainfall belt (Eig 1946).

CLIMATE

The mean annual rainfall of the location estimated by the Meteorological Service is 125—150 mm*. This corresponds well with the climatic calculations based on the ecological study of the plant-communities, as mentioned above. We must only consider that at this desert border the fluctuations of the annual rainfall amounts are extreme. A mean of 150 mm of rain may vary at least between 70 and 200 mm. The number of rainy days is limited, the bulk of the total amount falling in a few downpours. The rainy season coincides with the short winter (December—April), while the dry summer lasts from May to the end of November.

No data exist on amounts, periods, etc. of dew. In analogy with corresponding places in the Negev, however, dew would seem to occur frequently.

It is worth mentioning, too, that the rainfall in the season 1950/51 was extremely low (approximately 75 mm) and came late. Hardly any annuals were to be seen on the slopes except the very short-lived *Stipa tortilis* Desf. and the highly drought-resistant *Salsola inermis* Forsk. In spite of this exceptional drought, *Dactylis* did not seem to suffer, showing good development; it was thick luscious green, flowering. However, the plants were only 30—35 cm high.

CONCLUSION

Dactylis glomerata L. normally grows in much more humid areas, but was found here in a region of about 150 mm of rainfall.

The plant sociological analysis of the vegetation in its actual habitat shows, however, that its site benefits from additional run-off water, which would make the site roughly comparable with the sites of 250 to 300 mm rainfall. It must however be born in mind that the yearly fluctuations here are much greater, and that extreme droughts are much more frequent than in the area of 300 mm to which it is comparable.

The occurrence of *Dactylis glomerata* L. here seems doubtlessly to be the driest habitat of the species. That this find is not a "freak case" in this region is shown by the following facts which throw light on broader distribution. *Dactylis glomerata* L. has also been found in the neighbourhood of Beersheba (Figure 1,B), under similar run-off conditions, in an area of approximately 200 mm of rainfall (Mr. Joel De Angeles, verbal communication). It has also been recently found (April 1952) by Mr. Benzion Ginsburg of the Faculty of Agriculture of the Hebrew University, who saw it quite frequently in the wadis of the Jebel Hurashe, and the Jebel Lussan region, in the Central Negev Mountain area (900—1000 m above sea level, approximately 150—200 mm of rainfall; Figure 1,C). The occurrence of *Dactylis glomerata* L. in this region was once probably much more widespread. It may have suffered more than other plants from overgrazing, owing to its high palatability, and by the difficulty of its regeneration in this arid region.

* Data kindly supplied by Mr. Rosenan, Chief of the Climatological Division, Meteorological Service (see map).

On the other hand, *Dactylis glomerata* L. in the coastal plain with approximately 350 mm rainfall occurs there only on the northern slopes and on favourable soil (sandstone covered with loam). It distinctly enjoys comparatively better moisture conditions there than in the Negev Mountain area. Proof of this is the occurrence of *Cynodon dactylon* Pers. The details of its most southern appearance on the coastal plain can be seen from Square No. 5; also see Figure 1,D).

It can be concluded that the habitat in Wadi Migrah is one of a very drought resistant ecotype of *Dactylis glomerata* L. possessing better adaptations in this direction than any other type of this species in Israel, and perhaps anywhere. The seeds collected on May 17th and 27th, 1951, were made available to breeders in different countries.

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PHYTOSOCIOLOGICAL SQUARES (using scales of Brown-Blanquet) (Boyko 1947)

Situated 100 m from *Dactylis glomerata* L. Occurrence: on typical slope of the area (near Wadi Migrah, 25 km SE of Beersheba)
Soil: Campanian flint, very thin soil cover. Altitude: 500 m above sea level.

	Square No. 1							*Square No.* 2							*Square No.* 3						
	Area measured 1 × 1 *m* = 1 *m*² (*Numbers here modified to represent* 10*m*²)							*Area measured* 3 × 3.30 *m* = 10 *m*²							*Area measured* 2 × 2 *m* = 4 *m*² (*Numbers here modified to represent* 10 *m*²)						
Exposure (I.E. Factor)	*North* 10°							*North* 5°							*horizontal*						
Date	17.5.51							27.5.51							17.5.51						
Species	*No. of Individuals (approx.)*	*Abundance*	*Dominance*	*Sociability*	*Periodicity*	*Aver. diam. (cm)*	*Aver. height (cm)*	*No. of Individuals (approx.)*	*Abundance*	*Dominance*	*Sociability*	*Periodicity*	*Aver. diam. (cm)*	*Aver. height (cm)*	*No. of Individuals (approx.)*	*Abundance*	*Dominance*	*Sociability*	*Periodicity*	*Aver. diam. (cm)*	*Aver. height (cm)*
Stipa fontanesii Parl. M-IT	10	2	1	3	fruiting dry	20	40	—	—	—	—		—	—	—	—	—	—	—	—	—
Stipa tortilis Desf. sIT-SS (M)	30	3	1	1	dry	1	20	—	—	—	—		—	—	—	—	—	—	—	—	—
Artemisia herba alba Asso. IT	20	3	1	1	assimil.	30	20	9	2	1	1	assimil.	30	30	—	—	—	—	—	—	—
Gymnocarpus fruticosum Pers. sIT	20	2	1	1	fruiting dry	20	10	5	2	1	1	fruiting	35	25	—	—	—	—	—	—	—
Asphodelus microcarpus Viv. OM	20	2	1	2	dry	20	20	**	2	1	2	dry	—	—	—	—	—	—	—	—	—
Reaumuria palaestina Boiss. sIT	10	2	1	1	dry	2	5	—	—	—	—	—	—	—	8	3	1	1	assimil.	10	10
Helianthemum kahiricum Del. SS	—	—	—	—	—	—	—	1	1	1	1	fruiting	—	—	—	—	—	—	—	—	—
Atractylis cancellata L. sM-IT	—	—	—	—	—	—	—	2	2	1	2	flowering	20	10	—	—	—	—	—	—	—
Stipa parviflora Desf. sIT (M)	—	—	—	—	—	—	—	**	2	1	2	fruiting	—	—	—	—	—	—	—	—	—
Anabasis articulata (Forsk.) Moq. SS	—	—	—	—	—	—	—	1	2	1	1	assimil.	15	15	5	2	1	1	assimil.	10	5
Zygophyllum dumosum Boiss. SS	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	3	1	1	assimil.	30	20
Salsola inermis Forsk.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	3	1	1	dry	10	10

Plant distribution according to Eig (1931):
M — Mediterranean
IT — Irano-Turanian
SS — Saharo-Sindian
EB —
Tr — Tropical
EM — East-Mediterranean
OM — Omni-Mediterranean
( ) — Areas into which the species penetrates secondarily
SD — Sudano-Decanian

M about 25%
IT about 65%
SS about 10%

** Growing in the vicinity but outside the recorded square

M about 20%
IT about 50%
SS about 30%

M about 0%
IT about 25%
SS about 75%

Abundance:
1) very sparse
2) sparse
3) not numerous
4) numerous
5) very numerous

Dominance: (cover)
1) 1/20 (very scant)
2) 1/20 to 1/4
3) 1/4 to 1/2
4) 1/2 to 3/4
5) 3/4 to 4/4

Sociability:
1) growing one in a place, singly
2) grouped or tufted
3) in troops, small patches or cushions
4) in small colonies, in extensive patches, or forming carpets
5) in great crowds (pure populations)

PHYTOSOCIOLOGICAL SQUARE NO. 4

Soil: Bottom of small wadi bed, soft limestone, 5×20 metres along the wadi bed = 100 m².

Dominance: 25% rock and stones; 10% without vegetation; 65% vegetation.

Exposure (I. E. Factor): 10° Northwest.

Date: 6.4.51.

		Abundance	*Dominance*	*Sociability*	*Periodicity*	*Height (cm)*
Dactylis glomerata L.	EB-M-IT	3	1	2	flowering	30—35
Stipa parviflora Desf.	sIT (M)	3	2	2	fruiting	100
Hordeum bulbosum L.	M(IT)	3	1	2	flowering	100
Andropogon hirtus L.	M-IT-Tr	3	2	2	flowering	90
Teucrium polium L.	sM-IT (SD)	2	1	1	flowering	
Asphodelus microcarpus Viv.	OM	2	1	2	foliage	
Thymalaea hirsuta (L) Endl.	sM-IT	3	3	1		150
Ajuga chia (Poir.) (Schreb.)	EM-(IT)	3	1	1	flowering	
Avena sterilis L.	sM (IT)	3	1	1	fruiting	
Avena Wiestii Steud.	sIT(M-SS)	2	1	1	fruiting	25
Paronychia argentea Lam.	OM	3	1	1		
Poterium spinosum L.	EM	2	1	1		40
Urginea maritima (L.) Bak.	OM	2	1	1	foliage	
Ballota sp.		2	1	1	foliage	
Stipa tortilis Desf.	sIT-SS(M)	2	1	1	fruiting	25
Echinops Blancheanus Boiss.	EM	3	1	1	foliage	
Convolvulus spp.		3	2	1	flowering	
Erodium hirtum (Forsk.) Willd.	SS	3	1	1	flowering, fruiting	20
Erodium spp.		3	1	1	flowering, fruiting	15
Gymnocarpus fruticosum Pers.	IT	3	1	1	flowering	40
Atriplex halimus L.	SS	1	1	1	foliage	200
Lamarckia aurea (L.) Moench.	sM-IT(SD)	2	1	3	fruiting	10
Adonis dentata Del.	IT	1	1	1	flowering	8
Retama roetam (Forsk.) Webb	SS-sM	1	1	1		100

Mediterranean about 45%

Irano-Turanian about 40%

Saharo-Sindic about 15%

PHYTOSOCIOLOGICAL SQUARE NO. 5

Situated about 15 km east of Gaza, new road to Doroth, Southern Coastal Plain, Israel.

Soil: Red sandy loam on recent sandstone (Kurkar). Altitude: About 100 m.

Area measured $3 \times 3.3\text{m} = 10\text{m}^2$

Exposure (I. E. Factor): North-Northwest 28° (hill foot).

Date: 27.5.51.

Species		*No. of individuals*	*Abundance*	*Dominance*	*Sociability*	*Periodicity*
Dactylis glomerata L.	EB-M-IT	4	3	3	3	fruiting
Plantago albicans L.	sM-SS(IT)	8	3	2	2	fruiting
Ononis stenophylla Boiss.	sM	2	3	2	1	flowering, fruiting
Anchusa strigosa Labill.	sEM(IT)	1	2	1	1	flowering, fruiting
Thymelaea hirsuta (L.) Endl.	sM-IT	1	2	1	1	assimilating
Cynodon dactylon (L.) Pers.	Btr		3	3	2	fruiting
Hordeum bulbosum L.	M (IT)		2	1	2	fruiting
Asphodelus microcarpus Viv.	OM	1	2	1	2	dry

Remark: All species of this square record are components of the Anatolian steppe type in Israel (Boyko 1954).

THE EFFECTS OF CORTISONE AND GROWTH-HORMONE ON THE EMBRYONIC CHICK PITUITARY GRAFTED TO THE CHORIO-ALLANTOIC MEMBRANE

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In connection with studies on factors influencing the secretory state of the embryonic pituitary, observations were made on the effects of cortisone and of cortisone in combination with growth-hormone on chorio-allantoic grafts of early embryonic chick pituitary. The following is a short communication of the main results.

MATERIALS AND METHODS

The pituitary rudiments were dissected aseptically from 6-day embryos by the procedure described previously (Moscona and Moscona 1952), and explanted to the chorio-allantoic membrane of 8-day chick embryos through a small window cut in the shell. The windows were then sealed with a cover-slip which could be easily removed for daily injections of the hormones. Cortisone acetate (Cortone, Merck & Co.) was administered as a single injection of 1 mg per egg on the day of transplantation. Growth-hormone (Armour & Co.) was given daily throughout the course of the experiments in doses of 250 γ per egg. Untreated eggs and eggs injected daily with a control volume (0.2 cc) of Tyrode's solution served as controls. The grafts were collected after 6 and 8 days of cultivation, processed by the freezing-drying method (Gersh 1948), and stained with Heidenhain's azan and with the McManus-Hotchkiss periodic acid-leucofuchsin method.

RESULTS

It has been repeatedly shown that cortisone depresses the development of granulation tissue (Ragan 1950). Billingham et coll. (1951) have shown that cortisone applied locally or injected systemically lengthens the life of skin homografts mainly by retarding the systemic immunity to them. In the case of chorio-allantoic grafts the local application of cortisone resulted in an increased number of takes and a relatively better maintenance of the structure of the graft, this being due to the small degree of infiltration by the host tissues and a negligible inflammatory reaction.

Histological examination showed that the cortisone treated grafts consisted of epithelial cords packed closely together with little connective tissue in between. A small number of empty looking capillaries penetrated the graft tissue (Figure 2).

Grafts treated with growth-hormone in addition to cortisone showed considerably more connective tissue between the epithelial cords. There was a relatively abundant supply of blood capillaries. The graft tissue looked remarkably normal, resembling in its histological appearance the normal developing pituitary of corresponding age (Figure 3).

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In control grafts the epithelial cords were embedded in a mass of connective tissue rich in distended capillaries (Figure 1). In earlier stages the sections represented the typical appearance of homograft reaction, with characteristic infiltration by the host cells. Consequently the relative and probably also the absolute amount of the epithelial tissue was reduced when compared with grafts of the other two series.

Preliminary cytological examination revealed that the secretory cells were most abundant in grafts treated with both cortisone and growth-hormone (Figure 4). They appeared usually two days earlier than did the chromophils in the control grafts. The cells were mostly acidophils with few scattered basophils. The cytoplasm of the majority of the chromophil cells showed a strong affinity for aniline blue, the meaning of which is under investigation. The acidophilic granules tended to stain in a purplish hue rather than in the usual orange-red. Their characteristic appearance and their failure to stain with the McManus-Hotchkiss procedure supported their identification as acidophils.

In the grafts treated with cortisone only, the number of chromophilic cells was markedly smaller than in the cortisone-growth hormone treated tissue. Their differentiation, however, preceded that of chromophil cells in the control grafts.

Green and Whiteley (1952) pointed out that the application of cortisone might facilitate the growth of homologous and heterologous grafts. The present observations, while confirming in general this view, have shown that, as far as the differentiation of embryonic pituitary tissue is concerned, cortisone exerted some unfavourable effect which could be alleviated by simultaneous administration of growth-hormone. This conforms well with the previous observations of the possible antagonistic action of growth-hormone to cortisone in the developing chick embryo (Sobel 1954).

SUMMARY

The application of cortisone to chorio-allantoic grafts of embryonic chick pituitary increased the number of takes and reduced considerably the infiltration of the grafts by the connective tissue elements. Grafts treated with growth-hormone in addition to cortisone showed an almost normal quantitative relationship between the epithelial and the connective tissues. Such grafts, when compared with cortisone treated grafts and with controls, showed also the largest number of fully differentiated chromophilic cells.

I wish to express my deep gratitude to Professor I. Gersh of the Department of Anatomy, University of Chicago, in whose Laboratory this work was initiated, for introducing me to the method of freeze-drying of tissues for histochemical analysis.

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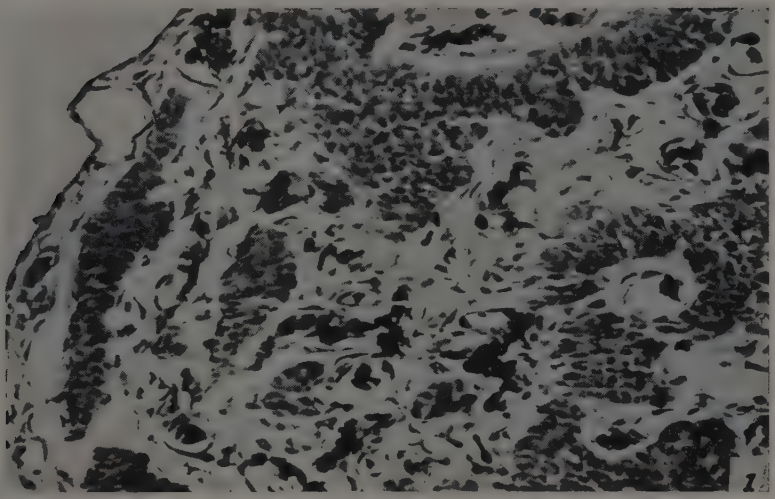

Figure 1

Section through a 6-day embryonic chick pituitary grafted on the chorio-allantoic membrane for 8 days. The untreated (control) graft shows a characteristic infiltration of the host's connective tissue, rich in distended blood capillaries, inbetween the epithelial strands. Frozen-dried; Azan; 935 x.

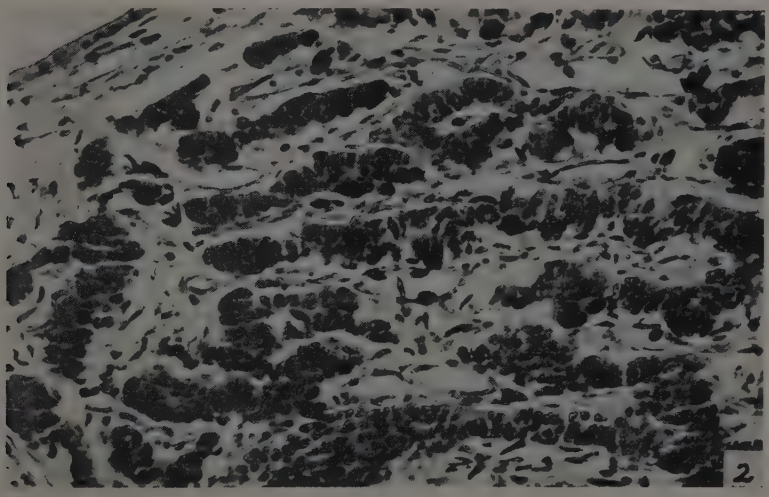

Figure 2

Section through a similar graft treated with a single injection of cortisone (1 mg). Note the narrow, dense connective tissue strands and the scarce supply of blood capillaries between the epithelial cords, which point toward retarded infiltration and depressed inflammatory reactions of the host tissues. Frozen-dried; Azan; 935 x.

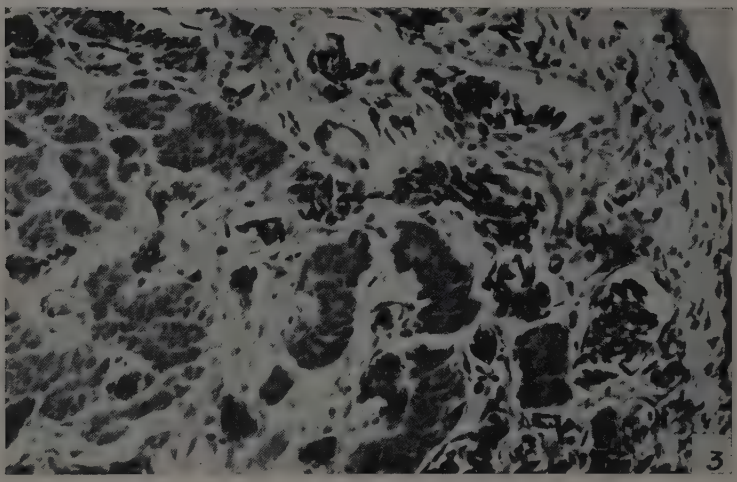

Figure 3

Section through a similar graft as in Figure 2, treated in addition to cortisone with daily injections of growth-hormone (250 γ per day). The amount of connective tissue is significantly more abundant than in the cortisone alone treated grafts, but scarcer than in the untreated controls. The proportional relationship between the connective and the epithelial tissues resembles that found in the normal developing pituitary of corresponding age. Frozen-dried; Azan; 935 x.

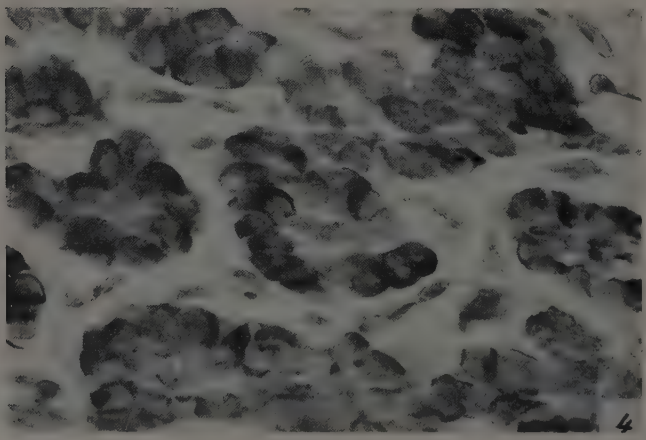

Figure 4

Section through a 6-day pituitary grafted on the chorio-allantoic membrane for 8 days and treated both with cortisone and growth-hormone. Glandular cords and lobules have formed and differentiated acidophil cells are characteristically arranged at their periphery. Frozen-dried; Azan; 1430 x.

SEASONAL CHANGES IN THE ISLETS OF LANGERHANS IN SNAKES

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It was reported by Houssay (1951) that administration of estrogens to subtotally pancreatectomized rats markedly decreased the incidence of diabetes in both sexes by bringing about a hypertrophy of the residual islets of Langerhans. On the basis of these and other findings Houssay suggested that estrogens might directly affect the islet tissue and exert, when in suitable concentrations, a characteristic stimulative influence not only under experimental conditions but also in the normal, intact rat and possibly also in other vertebrates. The following observations, summarized from a study of the pancreas in snakes, lead us to believe that in these animals there exists indeed a definite relationship between the state of the insular tissue and ovarian activity.

MATERIALS AND METHODS

Most of the islet tissue in snakes is localized in the "tail" part of the pancreas, towards the tip of which it forms several large concentrations. This part is usually incorporated in the rest of the compact gland, but in several species* it was found to form a discrete lobe, closely applied to the spleen. The lobe consists largely of islet tissue, which is thus readily accessible for examination. Our material included 31 males and 49 femelles (18 species) of snakes collected in various localities in Palestine throughout the year and examined usually shortly after collection. Numerous preserved specimens** were also examined. Changes in the total volume of the islet tissue were estimated from comparative measurements of the various parts in whole glands and in serial sections prepared from them; histological examination of the tissues and differential cell counts served to indicate the state of secretory activity.

RESULTS

In all adult females captured during the spring-summer season, that is during the period of reproductive activity, the total volume of the islet tissue was markedly larger than in females of closely comparable size examined at the ebb of the reproductive cycle or during the winter. Most of the females captured in spring showed mature ovarian follicles or bore eggs in early stages of development. The islet tissue in these females appeared clearly to be in a state of rapid proliferation: besides the

* *Eryx jaculus*, *Python regius*, *Typhlops vermicularis*, *Leptotyphlops macrorhynchus*, *Malpolon monspessulanus* and others.

** As a detailed descriptive report is in preparation, no additional data are given here.

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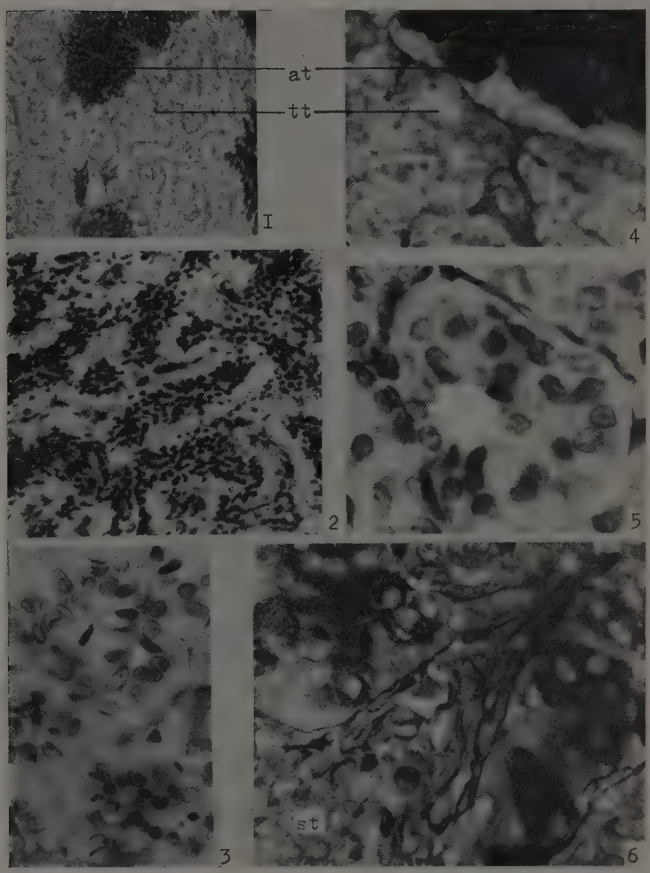

Figure 1. Pancreas of *Malpolon monspessulanus* ♀ captured in spring. Section through an area near the splenic end. Proliferating undifferentiated tubular tissue. Intracellular granules, typical of islet cells, are not visible at this stage. Haematoxylin and eosin. Obj. 10x, oc. 10x.
tt — tubular tissue; at — acinar tissue.

Figure 2. Enlarged area of tubular tissue from Figure 1 to show the chaotic appearance of the proliferating tissue. Haematoxylin and eosin. Obj. 60x, oc. 10x.

Figure 3. Enlarged area from Figure 2 to show the appearance of the tubular tissue cells.

Figure 4. Pancreas of *Eryx jaculus* ♀ captured in spring. Section through an area near the splenic end showing undifferentiated tubular tissue. Haematoxylin and eosin. Obj. 60x, oc. 10x.

Figure 5. Enlarged area from Figure 4 to show the structure of a tubulus. Haematoxylin and eosin. Obj. 90x, oc. 10x.

Figure 6. Spleen of *Malpolon monspessulanus* ♀ bearing maturing eggs. Intrasplenic penetrations of tubular tissue consisting of undifferentiated cells and of islet cells with typical granulation. Azan. Obj. 90x, oc. 10x.
st — splenic tissue.

typical secretory cells there were present relatively large masses of tubular tissue built of non-granular cells with numerous mitoses, representing newly formed, undifferentiated islet tissue. In their adenomalike appearance (Figures 1—5) these masses resemble closely the estrogen-induced tissue in the rat pancreas, as figured by Houssay. In females captured towards the summer and bearing maturing eggs, the increase in volume of the islet tissue had reached, apparently, its seasonal peak. This state was also marked by the considerable predominance in number of the fully differentiated secretory cells over the undifferentiated type. Due to their large volume, the masses of islet tissue were frequently found to bulge out of the smooth surface of the pancreas. This peak condition was remarkably conspicuous and most easily observable in the species with an insular lobe. The lobe was greatly enlarged and consisted almost entirely of islet tissue which penetrated frequently into and through the adjacent spleen to form intrasplenic islets (Figure 6) and suprasplenic macroscopical tubercles. Past the season of reproduction, various degrees and forms of regression and involution of the islet tissue were observed in all the species examined. These changes resulted ultimately in a considerable decrease in the volume of the islet tissue and, in cases of intrasplenic penetrations, in an almost complete disappearance of the intrasplenic islets and their replacement by strands of connective tissue and a few undifferentiated tubuli. No comparable changes were noted in the males.

COMMENT

The histological similarity between the newly-formed islet tissue in snakes and the estrogen-induced islet tissue in the rat raises the possibility of a similar causal effect in both instances. Estrogens were demonstrated to be present in the ovaries of snakes (Valle and Valle 1943) and there is also evidence of an increased gonadotrophic activity of the pituitary coinciding with the period of follicle maturation and egg formation (Cieslak 1945). As the proliferation of the islet tissue corresponds closely with this period, the possibility arises that the seasonal proliferation and regression of the islets of Langerhans tissue may be directly related to variations in the endocrine activity of the ovary.

It may also be assumed that the very conspicuous enlargement of the islet tissue during the period of egg formation is related to the metabolism of synthesis and accumulation of the egg constituents. A study of the functions of the hypertrophied islet tissue and the role of ovarian secretions in these processes is now in progress.

ACKNOWLEDGEMENT

I should like to express my thanks to Professor G. Haas for advice and help in this work.

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NEW AND INTERESTING BEES (*HYMENOPTERA, APOIDEA*) FROM ISRAEL

G. A. Mavromoustakis
Limassol, Cyprus

The bees described here were collected by H. Bytinski-Salz, Tel Aviv, Israel, and to a smaller extent by J. Wahrman, Jerusalem, Israel, and P. M. F. Verhoeff, Den Dolder, Holland. A part of the material was collected by me in Israel during June 1952. I am greatly indebted to the entomologists mentioned above for their kind contributions. The types have remained in my collection; paratypes were returned to the above collectors.

CERATINIDAE

EXONEURA

Exoneura (*Exoneuridia*) *libanensis* Friese

1899, *Exoneura libanensis* H. Friese, *Entom. Nachr.*, pp. 2—3.

Qiryat Shmone (Upper Galilee), 3 ♀, 15.VI.1952 (G. A. Mavromoustakis).

The genus *Exoneura* is an endemic Australian element not yet discovered in other parts of the old world. *Exoneura libanensis* Friese was known before only from the Lebanon—Brummana, and its presence in Upper Galilee is interesting.

Cockerell (1911) treated *Exoneura libanensis* Fr. as the *type* of his new subgenus *Exoneuridia*.

APIDAE

AMMOBATES

Ammobates constrictus sp. nov.

Female. — Length 9 mm.

Head and thorax black; mandibles with the base black, rest deep reddish brown; antennae black brown; second joint of the flagellum (antennal third joint) longer than first or third; third joint of the flagellum shorter than fourth (all seen from above); with the exception of a rather dense depressed pilosity below antennae, the head has extremely sparse and very short hardly visible pale white hairs.

Mesoscutum somewhat strongly rugosely punctate, moderately shining; scutellum slightly convex laterally, very slightly depressed longitudinally in the middle; mesoscutum with very sparse and very short pale white hairs; postscutellum very slightly convex in the middle and covered with depressed greyish white hairs; apical half of scutellum, anterior sides of propodeum, anterior half of mesopleura, pronotum broadly at its sides and narrowly in the middle — with greyish white hairs; triangle of the propodeum dull with a longitudinal impressed median line; tegulae black and punctate; wings infuscate, marginal cell strongly infuscate; distance of the first recurrent vein from the line of the apex of the first transverso-cubital vein nearly twice the distance of the second recurrent vein from the line of the apex of the second transverse cubital vein;

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pterostigma dark blackish brown, veins very deep brown; legs black; tarsi very deep brown, last small joint (except the claws) red brown; hind spurs dark black brown; apex of the hind tibiae truncate without any spine; tibiae and basitarsi covered with sparse, very thin and short pale white hairs above.

Abdomen deep reddish brown. First tergite with the apical margin constricted and somewhat narrower than the basal half of second tergite. First and second tergites with the base very finely and somewhat densely punctate, rest punctate, more densely at the sides; first and second tergites moderately shining, apical margins very broadly polished, impunctate and shining; third tergite with nearly the basal half punctate and moderately shining, apical margin polished, impunctate and shining; fourth tergite punctate, apical margin broadly polished, impunctate and shining; fifth tergite dark reddish brown in the middle, finely and densely punctate, apical margin very narrowly polished, impunctate and shining; sixth tergite small, completely polished, impunctate, very shining, apical margin rounded.

Pilosity on the tergites extremely poor, with some hardly visible, very thin and sparse, very short white hairs at the base of the second tergite and some very sparse and very short white hairs on the disc of the third and fourth tergites; sternites deep reddish brown; fourth sternite with its basal half very finely and very densely, partly rugosely punctate, apical half with similar sparse punctation (sides even more sparsely punctate than the disc), apical margin polished, impunctate and shining, broadly at its sides, and very narrowly in the middle; fifth sternite covered with very short and very thin white pubescence, denser on the apical margin, without any longitudinal carina; sixth sternite very long, apical margin very slightly incised in the middle.

Qiryat Shmone (Upper Galilee), 1 ♀ (*type*), 16.VI.1952, at *Cephalaria* (G. A. Mavromoustakis).

Ammobates constrictus sp. nov., with its peculiar constricted first abdominal tergite, is not related to any of the known Palaearctic species of *Ammobates*.

Ammobates bytinskii sp. nov.

Female.—Length 9.5 mm.

Black; basal half and apex of the labrum, mandibles (darkened at the apex), apical margin of the clypeus, reddish brown; antennae light reddish brown (some-what darkened at the apex), scape darkened except the apex; second joint of flagellum longer than the first, third or fourth joints; vertex shining; basal area of the clypeus, inner orbits a little above the insertion of the antennae, with somewhat dense pale hairs; vertex and occiput with somewhat sparse pale reddish yellow hairs.

Mesoscutum somewhat strongly and almost rugosely punctate, moderately shining; scutellum slightly convex at each side and very slightly impressed in the middle; tubercles light reddish brown, broadly yellow in front; mesoscutum with somewhat dense pale reddish pilosity on the anterior margin and rather sparse one on the disc and posterior margin; apical margin of scutellum bordered with similar hairs; postscutellum slightly convex in the middle and covered laterally with reddish yellow depressed hairs; tubercles deep reddish brown. Pronotum covered with pale reddish yellow depressed short hairs, broadly at the sides and narrowly in the middle; anterior mesopleura with pale reddish yellow hairs; propodeum with very short and thin whitish

hairs at each side; wings semihyaline; pterostigma black brown, veins deep brown; marginal cell very slightly infuscate above and slightly appendiculate at the apex; basal vein beginning very slightly basad of the transverse median vein; legs, with the exception of the coxae and trochanters, light reddish brown.

Abdomen light red, shining; tergites 1 to 3 very finely punctate, the punctation covering the apical margins; fourth and fifth tergites very finely punctate, the punctation covering the apical margins and somewhat more densely the apical half; tergites without depressions; sixth tergite short, broader than long, apical margin truncate in the middle and obtuse at the sides. Tergites 1 to 3 with very thin and short white lateral hair bands; fourth tergite with very thin latero-apical white hair band; fifth tergite covered nearly entirely with a very thin apical white hair band; sternites light red, with very sparse, very short and thin white tomentum; fifth sternite longitudinally carinate, the carina projecting slightly over the apical margin in the middle; sixth sternite short, deeply incised and sharply edged at the apex.

Tiberias springs, 1 ♀ (*type*), 2 ♀ (*paratypes*), 6.IV.1942. Ramat Gan, 1 ♀ (*paratype*), 3.V.1946 (H. Bytinski-Salz).

Ammobates bytinskii, sp. nov., may be compared with *Ammobates syriacus* Friese, of which I possess from Tiberias 1 ♀, 16.V.1945 (H. Bytinski-Salz), but these species differ in many details. *Ammobates syriacus* Friese, ♀, is smaller, with shining white pilosity everywhere on the head and thorax, first tergite with basal shining white dense hair band, tergites 2 to 4 with dense apical shining white hair bands at their sides, which do not reach the middle; fifth tergite with an apical entire shining white hair band; fifth sternite carinate longitudinally, but the carina not protruding over the apical margin in the middle; colour of the integument of the abdomen deep red; antennal scape deep reddish brown, first joint of the flagellum (second antennal joint) deep reddish brown, remaining joints dark brown.

Ammobates handlirschi Friese (1895), ♀, having length of the body 9 mm, and carinate fifth sternite and the carina projecting into a tooth, is a species related to *Ammobates bytinskii* sp. nov., but very different. The former has the sixth tergite prolonged, sixth sternite short and slightly incised in the middle, without pale reddish yellow hairs on the head and the dorsum of thorax, hind spurs black brown.

Ammobates roseus F. Morawitz (1895), ♀, differs in having the colour of the integument of all the body "pallide rufescens", tergites 1 to 5 with apical margin and the base of the first tergite covered densely with white hairs and the venation red.

Ammobates niveatus (Spinola) Friese

1838, *Phileremus niveatus* M. Spinola, ♀, *Ann. Soc. Entom. France*, **7**, 532.
1894, *Biastes niveatus* Dalla Torre & Friese, ♀, *Entom. Nachr.*, **20**, 38.
1895, *Biastes niveatus* H. Friese, ♀, *Bienen Europas*, **1**, 151.
1911, *Ammobates niveatus* H. Friese, ♀, *Arch. f. Naturg.*, **77**, p. 140.
1951, *Ammobates niveatus* V. B. Popov, *Trav. Inst. Zool. Acad. Sc. URSS*, **9**, 935.

Female.—Length 6.5 mm.

Head and thorax black; labrum black, long, shining, punctate at the base, the rest very sparsely punctate; mandibles deep reddish brown, apex darker; clypeus protruding, apical margin straight; inner sides of the eyes a little convergent below; antennae light

red, scape darkened above; second joint of the flagellum (third antennal joint) longer than broad, longer than the first, third or fourth; third and fourth joints nearly as long as broad, joints 5 to 9 a little longer than broad; the head completely covered with short snowy white depressed tomentum.

Mesoscutum densely covered with snowy white depressed tomentum, middle of the disc almost bare, shining, sparsely punctate; tubercles light red and covered with snowy white tomentum; tegulae light yellowish red; rest of the thorax densely covered with depressed snowy white tomentum; lower half of the propodeum bare only in the middle, polished and shining; wings hyaline; veins light yellow red; pterostigma light brown; marginal cell obliquely truncate and appendiculate at the lower margin of the apex; origin of the basal vein slightly basad of the transverse median vein; distance of the first recurrent vein from the line of the apex of the first transverse cubital vein more than two times the distance of the second recurrent vein from the line of the second transverse cubital vein. Legs light reddish brown; tibiae covered with snowy white depressed tomentum; hind tarsi with very thin similar pilosity, inner side with thin very short white hairs; hind spurs yellow red.

Abdomen light reddish brown; first tergite covered with snowy white depressed tomentum; tergites 3 to 5 covered with snowy white depressed tomentum, apical margins light reddish yellow; sixth tergite short, apex truncate, base a little broader than the apical margin and covered with very thin, very short white hairs, intermixed with longer and very sparse erect similar hairs; sternites bare, shining; fifth sternite longitudinally carinate in the middle, the carina protruding a little over the apical margin; sixth sternite much reduced.

Bat Yam, 1 ♀, 3.VI (H. Bytinski-Salz).

Phileremus niveatus Spinola has been briefly described from a unique *female* from Egypt (1838), and later Dalla Torre and Friese (1894) included this species in the genus *Biastes*. I am of the opinion that Spinola correctly placed this bee in *Phileremus* Latr., which is a synonym of *Ammobates* Latr. The genus *Ammobates* has page priority of the genus *Phileremus*. Friese furthermore (1911) transferred correctly the same species to *Ammobates* and gave a redescription of *Ammobates niveatus* ♀. I am of the opinion that the *female* described by Friese as *Ammobatus niveatus* is identical with Spinola's *Phileremus niveatus*, and Friese made a new combination. The *female* from Bat Yam (Israel), as described above, is identical with the descriptions of Spinola and Friese, but with very slight differences concerning the distribution of pilosity. Spinola described the first, fourth and fifth abdominal tergites as covered with snowy white tomentum, and Friese described the first, apical half of second and third, and fourth and fifth tergites as completely covered with similar tomentum. My specimen from Bat Yam has the first, apical half of the second, and tergites 3 to 5 covered with snowy white tomentum. These differences are of minor importance.

Ammobates latitarsis Friese

1899, *Ammobates latitarsis* H. Friese, *Entom. Nachr.*, p. 1.
1935, *Ammobates latitarsis* J. D. Alfken, *Ver. Deutsch. Kol.-Uebersee-Mus. Bremen*, **1**, 176.
1938, *Ammobates latitarsis* J. D. Alfken, *Deutsch. Entom. Zeitschr.*, p. 425.

Jericho, 1 ♀, 9.IV. 1943. Jerusalem, ♂ ♂ ♀ ♀, 1.-4. V. 'Affula, ♂ ♀, 28.III.1942. 'Ein Gev, 1 ♀, 23.IV.1943. Beersheba, 2 ♀, 1.IV.1943 (all H. Bytinski-Salz).

This species has been described from Jericho and Bethlehem and recorded from Jerusalem (1938). It is well separated from all the other known species of *Ammobates* in having the hind basitarsi much enlarged in both sexes.

Ammobates syriacus Friese

1899, *Ammobates syriacus* H. Friese, *Entom. Nachr.*, p. 1.

Tiberias, 1 ♀, 16.V.1945 (H. Bytinski-Salz).

Ammobates syriacus Friese has been described from Jericho, and has not been recorded from other parts of Israel since the original description; it is very closely related to *Ammobates mavromoustakisi* Popov from Cyprus. The former has a deeper red cuticular colour of the abdomen, the sixth tergite much broader than long and much shorter than the sixth tergite of the latter species.

Oxybiastes, gen. nov.

Male.—Maxillary palpi two-jointed, first joint a little broader and much longer than second; labial palpi with two basal joints elongate and flattened, the apical two joints small and cylindrical; labrum broader than long, very short, not surpassing the closed mandibles. Eyes not large, inner side of the eyes divergent above; scape of the antennae short, broad and hairy; antennae 13–jointed; flagellum (antennal joints 2 to 12) with the second joint longer than broad but not very long, much longer than the first, a little longer than the third, or longer than each of the remaining joints; flagellar joints 4 to 11 as long as broad; head and thorax covered with erect hairs. Scutellum plane, not protruding, and with the angle of the apical margin obtuse; axillae with small projecting and obtusely edged spine; postscutellum plane; no pleural scrobe. Marginal cell long, elongate, ovate at the tip, slightly appendiculate at the apex, longer than the distance from its apex to the wing tip and its apex a little away from the wing margin; two submarginal cells, the first slightly larger than the second; the second submarginal cell receiving both recurrent veins; pubescence of the fore wing evident, somewhat sparse and more or less uniform; pterostigma much reduced; ten hamuli on the hind wing; jugal lobe of the hind wing much reduced, obtusely edged at the apex and very much shorter than the anal lobe; basal vein originating considerably basad of the transverse median vein; seventh tergite with a pygidium as in *Ammobatoides abdominalis* Ev. *male*, but a little broader; punctation of the thorax strong and that of the abdomen very fine; abdominal tergites with small lateral maculae of snowy white depressed hairs; no depressions on the three anterior tergites; arolia (pulvilli) present; the claws of the hind legs simple, not bifid; sternites with dense erect and stiff hairs.

Genotype: *Oxybiastes bischoffi* sp. nov.

This new parasitic genus of bees shares with the *Ammobatoidini* (*Ammobatoides*) only the form of the marginal cell, and it is very different in all other morphological characters (eyes etc.). It is also excluded from all the *Ammobatini* by the form of the marginal cell which in the latter tribe is slightly shorter than the distance from its apex to the wing tip and obliquely truncate at the apex. This new genus is not related to the *Dioxini* in having pulvilli, and it is not allied to the *Megachilidae*. *Oxybiastes* gen.

nov. is only related to the *Biastini* (*Biastes*) by its broad labrum and the shortened antennal scape. In *Biastes brevicornis* Nyl. the *male* antennae are 13-jointed, while in the other species the joints of the male antennae are twelve. Owing to the fact that we do not know the *female* and the *male* genitalia of the genotype, I am now including this new genus of bees into the tribe of *Biastini*, and its definite position will be decided when more material is available of both sexes.

Oxybiates bischoffi sp. nov.

Male.—Length 9 mm.

Black; mandibles edentate, with obtusely edged tip, base black, rest reddish brown, with some golden setae on the lower sides; labrum broader than long, with black brown hairs; clypeus densely rugosely punctate, moderately shining, apical margin narrowly polished and shining, disc covered with erect, somewhat stiff black hairs; antennal scape short and covered with black hairs; second joint of the flagellum (third antennal joint) brown, the remaining joints black; second joint of the flagellum longer than the third or fourth; third joint of the flagellum somewhat longer than the fourth (seen from above); face below ocelli completely covered with somewhat long, erect and stiff dark brownish black hairs; occiput with some erect grayish hairs; cheeks covered with erect somewhat long and dense dark brownish black hairs.

Mesoscutum moderately shining, strongly rugosely punctate and covered with erect, somewhat long and stiff greyish hairs; pronotum with similar hairs; scutellum, postscutellum and propodeum with erect dark brownish black hairs, those on the scutellum somewhat longer; thorax covered with somewhat long, erect and dark brownish black hairs at the sides and beneath; tegulae finely punctate and deep brown. Wings slightly infuscate; veins and pterostigma dark brownish black. Legs dark brown; femora with erect brownish black hairs below; tarsi dark reddish brown, basitarsi darker than the small joints; hind spurs brown.

Abdomen moderately shining; first and second tergites very finely punctate, subapical area and apical margin tinged with brown; first and second tergites long, the second somewhat longer than the first; first tergite with a patch of snowy white depressed hairs nearly covering the sides; second tergite with a patch of snowy white depressed hair nearly covering the lower half of each side; third and fourth tergites with a small rounded mark of snowy white depressed hair at each side. Pygidium of the seventh tergite short, base broader than the obtusely edged tip; second sternite much longer than the first, longitudinally subcarinate in the middle from the base to the subapical area; subapical area of second sternite slightly triangularly impressed, tinged with brown and covered with thin very short greyish black hairs; sternites 3 to 5 with the apical margin covered with erect, somewhat stiff and greyish black hairs.

Jerusalem, 1 ♂ (*type*), 29.III.1940 (H. Bytinski-Salz).

I have pleasure in naming this remarkable species after Professor Dr. H. Bischoff, Zoological Museum, Humboldt University, Berlin.

MEGACHILIDAE

OSMIA

Osmia singularis F. Mor.

1875, *Osmia singularis* F. Morawitz, ♂, Fedtschenko: Turkestan, Apid., **1**, 89.

Tiberias, 1 ♂, 9.V.1951 (P. M. F. Verhoeff).

Originally described from Turkestan and new for Israel.

Osmia wahrmani Mavrom.

1948, *Osmia wahrmani* G. A. Mavromoustakis, ♂ ♀, *Ann. & Mag. Nat. Hist.* (12), **1**, 218.

Ramat Gan, 4.V—28.VI (G. A. Mavromoustakis, P. M. F. Verhoeff, H. Bytinski-Salz), at *Centaurea* sp. Jaffa, 3.V—14.VI (G. A. Mavromoustakis, P. M. F. Verhoeff, H. Bytinski-Salz), very common at flowers of *Centaurea* sp. Bat Yam, many ♂ ♂ ♀ ♀ 21.IV—19.VI (G. A. Mavromoustakis, H. Bytinski-Salz), at flowers of *Centaurea* sp. Dorot 15.IV. Beerot Yitzhaq 25.V. Urim 12.V. Nahariya 11.VI (H. Bytinski-Salz).

On 14th June 1952 Dr. Bytinski-Salz showed me a nesting colony of *Osmia wahrmani*, at Bat Yam (near Jaffa), in a hard sandy soil. The galleries of the bee do not exceed 5 cm, and the cells are constructed from the yellow flowers of *Oenothera* sp., growing rather common in the locality. *Osmia wahrmani* Mavrom. is an endemic, very common species in the light red soil area of Tel Aviv, Jaffa, Bat Yam, Ramat Gan, Miqve Israel. It is an *oligotrophic* bee, visiting the flowers of *Centaurea* sp.

Osmia sordita R. Benst. (syn: *bodenheimeri* Mavrom.)

1929, *Osmia sordita* R. Benoist, ♂, *Bull. Soc. Entom. France*, p. 99.
1935, *Osmia sordita* J. D. Alfken, *Ver. Deutsch. Kol.-Uebersee-Mus. Bremen*, p. 175.
1938, *Osmia sordita* J. D. Alfken, *Deutsch. Entom. Zeitschr.*, **2**, 424.
1949, *Osmia bodenheimeri* G. A. Mavromoustakis, *Eos*, **25**, 289.

Bnei Braq, 28.VI.1948 (H. Bytinski-Salz). Jaffa, 3.V.1951 (P. M. F. Verhoeff). Ramat Gan, many ♂ ♂ ♀ ♀, 13.VI.1952 (G. A. Mavromoustakis), at *Echium*. Bat Yam, 1 ♀ (*allotype*), 14.VI.1952 and many ♂ ♂ ♀ ♀, 21.IV—19.VI (G. A. Mavromoustakis, H. Bytinski-Salz), at *Echium*. Pardess Hanna, 1 ♀, 11.VII.1946, Nahariya, 11.VI (Bytinski-Salz). All ♀ ♀ *paratypes*.

During my entomological trip to Israel (June 1952), I collected a good number of both sexes of *Osmia bodenheimeri* Mavrom., a species known to me before only from the *type* and *allotype*. Benoist (1929) described *Osmia sordita* from Jaffa from a unique *male* (in the Museum d'Histoire Naturelle, Paris), and *Osmia sordita* was considered by me (1949) as the only species closely related to *Osmia bodenheimeri* Mavrom. By close research in the vicinity of Jaffa, Bat Yam and the nearby light soil area of Ramat Gan, I collected only *Osmia bodenheimeri*, and Mr. Bytinski-Salz, who collected extensively for a long time in the same area, had the same experience. I am now convinced that *Osmia bodenheimeri* Mavrom. is a synonym of *Osmia sordita* R. Benst., the latter having priority, and what I have described as the unknown *female* of *Osmia sordita* (1949) is a new genus which I am describing later as *Bytinskia*. The main differences on which I based the separation of *Osmia sordita* R. Benst. and *Osmia bodenheimeri* Mavrom. were as follows: the *male* of *Osmia bodenheimeri* "between the second and third joint the flagellum is concave (when seen from the front), second joint of the flagellum longer than the first, third or fourth" and the "mandibles are yellow". Benoist in his short original description of *Osmia sordita* very probably omitted to describe the peculiarity of the second and third joints of the flagellum, and in saying in his description that "le second article des antennae plus long que le 3", meant really the flagellum and not the antennae. Thus the two species agree in the form of the

first joints of the antennae, and their other differences are of minor importance. The colour of the mandibles of *Osmia sordita* was described by Benoist as testaceous and brown at the apex; in my present series such cases of testaceous colour of mandibles or nearly so, are not rare.

Osmia sordita R. Benst. is common in the vicinity of Jaffa, Bat Yam and Ramat Gan, nests in a hard sandy soil at road sides or near the plants of *Echium*, and is another endemic *oligotrophic* bee visiting the flowers of *Echium*, very probably *Echium sericeum* Vahl. *Osmia sordita* R. Benst. may be compared with other related species of the same group (the group of *Osmia crenulata* F. Mor.) described from Israel as follows:—

Osmia wahrmani Mavrom. This species has the propodeum shining (in *Osmia sordita*, dull); tergites 1 to 5 red, with transverse dense and broad white hair bands (in *Osmia sordita*, tergites black, apical margins of tergites 1 to 5 broadly yellowish brown and the hair bands not so thick and broad); in the *male* the first joints of the flagellum are regular (in *Osmia sordita*, flagellum concave between the second and third joints). Second sternite emarginate in the middle and yellowish brown, apical margin of third sternite somewhat deeply emarginate in the middle (in *Osmia sordita*, apical margin of the second and third sternites without emargination).

Osmia semirubra Friese. Endemic species distributed in the lower Jordan Valley (Jericho) reaching the vicinity of Jerusalem. *Female:* propodeum shining (in *Osmia sordita*, dull); tergites 1 to 5 with transverse apical, narrow and rather thin, white hair bands, those on the first and second tergites attenuated or interrupted in the middle (in *Osmia sordita*, tergites 1 to 5 with apical margins having dense, entire and narrow white hair bands); colour of the integument of abdomen red (in *Osmia sordita*, black, with apical margins broadly yellowish brown). *Male:* abdomen black, tergites 5 to 7 light reddish brown, seventh tergite with two short and broad lobes and with a semicircular emargination between the lobes (in *Osmia sordita*, black, apical margins broadly yellowish brown, seventh tergite bifurcate, the narrow and short spines parallel and obtuse at the apex).

Osmia hierichonica Mavrom. Endemic species distributed in the lower Jordan Valley to the Dead Sea. *Female:* propodeum dull; clypeus convex, shining, densely and finely punctate, with a narrow polished basal longitudinal area reaching the middle of the disc (in *Osmia sordita*, clypeus slightly convex, finely punctate and shining, almost completely covered with short white hairs); apical margin of abdominal tergites 1 to 5 black (in *Osmia sordita*, broadly yellowish brown). *Male:* similar to the *female;* second sternite with the apical margin entire and straight, third sternite with the apical margin very slightly emarginate in the middle (in *Osmia sordita*, second and third sternites without apical emargination, second sternite with a slight longitudinal and narrow convexity in the middle of the disc when seen from the side). All the species mentioned above belong to the group of *Osmia crenulata* F. Mor. In this group the *males* have seventh abdominal tergite bifurcate.

Osmia leiocephala sp. nov.

Female.—Length 7 mm.

Black; clypeus very shining, the median area to the basal margin longitudinally and broadly polished and impunctate, laterally somewhat finely and densely rugose-punctate.

apical margin entire and slightly crenulate; supraclypeal plate (area) polished, impunctate and shining, finely and laterally somewhat rugose-punctate; mandibles tridentate, yellowish brown, teeth dark reddish brown; scape black, narrowly red brown at the apex; first and second joints of the flagellum (second and third antennal joints) dark brown, remaining joints of the flagellum yellow brown; clypeus (except the middle of its disc), inner orbits around the insertion of the antennae, cheeks, with dense white hairs; vertex and occiput with short greyish white hairs.

Mesoscutum very shining, somewhat densely and finely rugose-punctate, anterior part of the disc to a little beyond the parapsidal line broadly sparsely punctate; propodeum dull; tegulae yellow red; wings hyaline; pterostigma deep brown, lighter in the middle; disc of the mesoscutum nearly entirely bare of hairs, with erect greyish white hairs in front and at the sides; scutellum with disc entirely bare, apical margin with erect greyish white hairs; propodeum at each side, sides of the thorax and sternum, densely covered with shining white hairs. Anterior and middle femora black, narrowly reddish brown at the apex, with dense silky white hairs on the outer sides; hind femora reddish brown, darkened at the base, with sparse silky white hairs on the outer sides; anterior and middle tibiae dark red brown and black, with silky white hairs above; hind tibiae deep red brown and covered with dense silky white hairs except on the inner side; tarsi red brown, hind basitarsi shorter than tibiae, deep red brown; hind basitarsi with dense and short fringe of silky white hairs above, thin and very short similar hairs on the outer side and dense short golden hairs on the inner side; hind spurs yellowish.

Abdomen shining, reddish; first and second tergites densely and very finely punctate; tergites 1 to 5 with thick and broad silky white, transverse and complete hair bands; sixth tergite covered with silky white depressed pubescence; disc of fifth and sixth tergites with a longitudinal darkness of the cuticular colour in the middle; ventral scopa greyish white.

Male.—Length 7 mm.

Similar to the *female;* black; mandibles long, yellow, shortly tridentate, teeth brown; head below the ocelli covered with dense silky white hairs; cheeks with similar hairs; femora and tibiae black, red brown at the apex; tarsi red brown, basitarsi deep brown, hind basitarsi dark brown; first and second small joints of hind tarsi somewhat darkened.

First abdominal tergite deep red brown, base mostly darkened laterally, tergites 2 to 6 with the apical margins broadly deep red brown; second tergite with the base deep red brown, a little darkened in the middle of the disc and all of the subapical area; sixth tergite broad and short, basal sides with a spine; seventh tergite bifurcate, the spines straight and parallel, obtusely edged; pilosity on tergites almost rubbed off (the specimen old when collected); fourth and fifth tergites with entire silky white apical hair bands; sixth tergite with discal and apical long hairs; sternites shining; second sternite long and broad, almost bare, somewhat longitudinally convex in the middle, and with a subapical rounded short elevation in the middle; apical margin of the third and fourth sternites entire, with a dense fringe of dull white hairs.

15 km south of Kurnub, 1 ♀ (*type*), 1 ♂ (*allotype*), 1 ♀ (*paratype*), 20.III.1946. Wadi Fukra, 3 ♀, 26.IV.1940. Kfar Yeroham, 4 ♂♀, 20.IV.1944 (*paratypes*) (all H. Bytinski-Salz).

Osmia leiocephala sp. nov. belongs to the *Osmia crenulata* F. Mor. group and comes near to *Osmia speculum* R. Benoist (1934) from Algeria and *Osmia pseudospeculum* R. Benoist (ibid. p. 107) from Morocco. The latter two species are closely related and their descriptions are very short, so their interpretation is somewhat difficult. The species differ as follows:

Osmia speculum R. Benoist, *female*. Black; antennae black; clypeus with a broad longitudinal polished and impunctate line passing through the supraclypeal plate (area) and reaching the base of the front; length of the body 9 mm.

Osmia pseudospeculum R. Benoist, *female*. Black; abdominal tergites with the apical margins rufous; antennae shorter and thicker than in *Osmia speculum* and ferruginous; clypeus as in *Osmia speculum*, but the apical margin truncate and briefly crenato-tuberculate; length of the body 9 mm.

Osmia verhoeffi sp. nov.

Female.—Length 5 mm.

Black; clypeus covered with dense shining white short hairs, apical margin not crenulate but straight and entire; mandibles tridentate, yellow brown; scape black; flagellum brown, first and second joints deep brown; face below the front with dense shining white hairs; cheeks densely covered with very short depressed hairs covering the surface and some very sparse long erect hairs, all pale. Mesoscutum very finely punctate, shining, bordered in front and at the sides with shining white hairs, disc with very short pale depressed hairs not covering the surface; scutellum bordered with long erect pale hairs, disc with very short pale depressed hairs; tegulae yellow brown; wings hyaline, veins and pterostigma brown; thorax with dense erect shining white hairs at sides and beneath; propodeum (visible in a *paratype*) dull, minutely and very densely granulate-punctate; anterior and middle femora black brown, base and apex narrowly yellow red; hind tibiae yellow red with deep black brown suffusion towards the middle; tibiae above and on the outer side with dense shining white hairs, femora with similar hairs beneath and on the outer side; all tarsi yellow red; hind spurs whitish. Abdomen pale red, shining; first and second tergites somewhat minutely punctate; tergites 1 to 5 with apical, entire and dense white hair bands, disc of the fourth and fifth tergites with very thin and short sparse white hairs; sixth tergite covered with somewhat short shining white hairs; first sternite yellowish red; remaining sternites brownish black, apical margins narrowly pale; ventral scopa white.

Male.—Length 5—5.5 mm.

Black; mandibles tridentate, pale, teeth reddish brown; the face completely covered with shining white hairs; occiput with short erect shining white hairs; cheeks covered with very short shining white hairs; antennae not modified. Thorax covered with shining white hairs, those on the disc of the mesoscutum short and sparse, not covering the surface; legs with shining white hairs; femora black, apex narrowly yellowish red; tibiae black, base and apex yellowish red; tarsi yellowish red. Abdomen black (in a *paratype* first tergite slightly tinged with red on the base at each side); apical margin of tergites 1 to 6 narrowly pale (in a *paratype* the subapical area very narrowly tinged with reddish); sixth tergite with very short lateral spine, apical margin entire and semihyaline; seventh tergite with two short, distant and parallel obtusely edged narrow

spines; tergites 1 to 5 with thin transverse white apical bands (in some *paratypes* rubbed off or broadly interrupted); disc of the tergites with sparse and very thin, very short white hairs; sternites shining, black brown; apical margin of sternites 2 to 4 with thin white hair fringe, those on the second and third semihyaline and entire; apical margin of the fourth sternite widely emarginate and that of the first sternite straight.

Bat Yam, 1 ♀ (*type*), 15.IV.1953 (H. Bytinski-Salz); 1 ♂ (*allotype*), 5—21.V.1951 (P. M. F. Verhoeff); ♂ ♂ ♀ ♀, 18.IV—21.V (P. M. F. Verhoeff, H. Bytinski-Salz) (*paratypes*).

This very small *Osmia* belongs to the group of *Osmia crenulata* F. Mor., and is not related to any of the known Palaearctic species of *Osmia*.

It is named after Mr. P. M. F. Verhoeff, Den Dolder, Holland.

Osmia paralias sp. nov.

Female.—Length 6 mm.

Black; clypeus protruding and shining, convex, apical margin with a rather deep and broad median emargination and bluntly angular sides; disc densely punctate but very sparsely punctate in the middle, with a longitudinal narrow median furrow starting from the basal margin and reaching the apical margin in the middle of the emargination; mandibles black; vertex and occiput densely and finely punctate, shining; scape black; flagellum, with the exception of the basal three black joints, light brown; pilosity on the head sparse and short, white. Mesoscutum and scutellum very shining, somewhat sparsely and finely punctate; propodeum with the basal area dull, finely granulate-punctate, rest shining, sparsely punctate, median triangle polished, impunctate and shining; tegulae yellow brown. Wings semihyaline; pterostigma brown; pilosity on the dorsum of the thorax sparse and white, a little denser on the scutellum; anterior tarsi deep red brown (basitarsi darker); middle tarsi black brown, last two small joints deep red brown; hind tarsi black brown, last small joint deep red brown (in one *paratype* anterior and middle tarsi deep red brown, the basitarsi darker, last small joint of hind tarsi deep red brown; hind basitarsi deep red brown); hind spurs yellow brown, slightly curved at the apex; pilosity on legs sparse and white. Abdomen shining; first and second tergites very finely and densely punctate, apical margin almost minutely and very densely punctate; apical margin of tergites 1 to 5 yellow brown; tergites 1 to 5 with thin transverse and apical shining white entire hair bands, disc with very sparse and short similar hairs; sixth tergite covered with short white hairs (in a *paratype* the hair bands interrupted owing to the worn state of the specimen). Scopa white.

Male.—Length 5.5 mm.

Similar to the *female*; head covered with dense shining white hairs, the hairs on the cheeks, vertex and occiput less dense; flagellum yellow brown, first and second joints black brown. Thorax with shining white hairs, those on the disc of the mesoscutum less dense and those on the scutellum a little longer. Abdominal tergites with very short shining white hairs forming transverse bands on tergites 1 to 5 (anterior ones broadly interrupted); sixth and seventh tergites covered with very short shining white hairs; sixth tergite with its apical margin entire, bluntly angulate sublaterally and tinged

with red brown, seventh tergite very short, transparent and yellow, very slightly surpassing the apical margin of the sixth tergite; sternites shining; apical margin of sternites 2 to 5 entire, those of first and third sternites hyaline; first and second sternites with apical thin white hair bands; fifth sternite with apical, thin pale hair band.

Bat Yam, 1 ♀ (*type*), 16.IV.1946; 1 ♂ (*allotype*), 21.IV.1946 (H. Bytinski-Salz); ♂ ♂ ♀ ♀ (*paratypes*), 15.IV — 5.V (H. Bytinski-Salz, P. M. F. Verhoeff).

Osmia paralias sp. nov. may be compared with *Osmia* (*Stenosmia*) *flavicornis* F. Morawitz (1878), but these two species differ as follows: *Osmia flavicornis* F. Mor., *female*, has the mandibles blood red in the middle (in *Osmia paralias*, black); the clypeus produced (in *Osmia paralias*, clypeus as described above). In the *male* the seventh tergite with truncate apical margin (in *Osmia paralias*, rounded), fifth sternite densely white haired, sixth sternite with a longitudinal carina (in *Osmia paralias*, fifth sternite with apical margin only pale haired, sixth sternite not visible or in a depression). *Osmia excisa* F. Morawitz (1880), from Central Asia, ♀, is also a related species and differs in several morphological details. *Osmia excisa* F. Mor., *female*, has the clypeus shining with a polished broad longitudinal zone and laterally of it finely and densely punctate, apical margin protruding and directed upward with a deep emargination in the middle (in *Osmia paralias*, clypeus as described above). Tegulae black with brownish margin (in *Osmia paralias*, tegulae yellow brown); head sparsely grey haired (in *Osmia paralias*, pilosity on the head short, sparse and white); apical margin of tergites 1 to 5 black, without complete transverse shining white hair bands, last tergite grey haired, remaining tergites very sparsely haired (in *Osmia paralias*, apical margin of tergites 1 to 5 yellow brown, with thin and transverse shining white hair bands, disc of tergites with very sparse and short similar hairs, sixth tergite covered with short white hairs); hind spurs rusty red (in *Osmia paralias*, yellow brown, slightly curved at the apex).

Osmia latipes F. Mor. *var.*

1875, *Osmia latipes* F. Morawitz, ♀, in Fedtschenko: Turkestan Apid., **1**, 97.
1952, *Anthocopa* (*Haetosmia*) *Latipes* V. B. Popov, *Trav. Inst. Zool. Acad. Sc. URSS*, **10**, 103.

Female.—Length 6—6.5 mm.

Black; clypeus convex, shining, very densely and somewhat finely punctate, apical margin protruding and rounded at the sides, coloured broadly reddish; mandibles short and tridentate, reddish, base narrowly black brown, teeth dark reddish brown; vertex shining, somewhat densely punctate; scape black; flagellum brown (except the blackish brown first joint); head below the ocelli with dense snowy white hairs; clypeus covered with similar hairs above and at the sides, apical half of the disc and the apical margin with thin and very short pale fulvous hairs not covering the surface (rubbed off in old specimens); vertex with very sparse and short depressed yellowish white hairs; occiput with short yellowish white hairs, sparse in the middle; cheeks covered with dense and short depressed white hairs. Mesoscutum somewhat sparsely punctate, shining, disc almost bare and bordered with dense white hairs; scutellum with similar punctation, shining, with dense white hairs except the bare disc in the middle; postscutellum densely covered with short white hairs; wings hyaline; pterostigma brown; thorax with dense and short white hairs at the sides and beneath; tibiae and tarsi red; femora below with shining white hairs; tibiae above with shining white hairs, denser on the hind ones; anterior basitarsi *much enlarged*; remaining basitarsi regular, hind

basitarsi with dense shining white hairs on their outer side; hind spurs yellowish white. Abdomen shining; tergites 1 to 3 reddish, with apical margins yellowish red, remaining tergites black, with apical margins yellowish red; fourth tergite tinged reddish laterally or black, apical margins yellowish red; first tergite covered with dense depressed and short snowy white hairs, except a narrow zone in the middle of the disc; second tergite with the basal half bare except a narrow zone at the sides, finely and sparsely punctate, apical half very finely densely punctate and covered with short snowy white depressed hairs; third tergite with the basal half bare (except a narrow zone at the sides), densely punctate; tergites 4 to 6 covered with dense and short depressed snowy white hairs, base of the fourth narrowly bare and very densely and finely punctate; second and third tergites with white hairs at the sides; ventral scopa white; sternites 1 to 5 with short apical shining white hair bands at the sides; sternites nearly reddish brown.

Male.—Length 6.5 mm.

Head below the ocelli densely covered with snowy white hairs; antennae long, reaching the base of the scutellum; first joint of the flagellum (second antennal joint) shorter than second or third; second joint of the flagellum a little shorter than third. Hind coxa with a short spine at the inner side. Abdomen very dark brownish black or black with apical margins yellowish red or black, subapical area of tergites 1 to 5 narrowly reddish and the apical margin pale; pilosity on the tergites as in the *female*; sixth tergite broader than long, with a short spine at each side and covered with snowy white hairs, apical margin entire; seventh tergite reddish brown, short, broader than long, with parallel sides, apical margin truncate and with rounded sides; sternites reddish brown and bare; first sternite with the apical margin truncate; second sternite bare, long, slightly elevated, apical margin very slightly emarginated in the middle; third and fourth sternites with the apical margins emarginated in the middle.

Ramat Gan, 1 ♂ (*allotype*), 29.VIII.1946, at *Heliotropium* (J. Wahrman); 13.VI.1952, at *Heliotropium* sp. (G. A. Mavromoustakis). Bnei Braq, 28.V.1948 (H. Bytinski-Salz). Gat, 3.VI (H. Bytinski-Salz). Beersheba 13—23.VI, at *Heliotropium* sp. (G. A. Mavromoustakis and H. Bytinski-Salz). Jerusalem, Wadi Ruaz, 2 ♀, 28.VI.1952, at *Heliotropium* sp. (G. A. Mavromoustakis). Numerous ♂ ♂ ♀ ♀, the ♂ ♂ *paratypes*.

Originally described from Kisilkum desert, Turkestan, and known to me from Balaban Bridge, Asiatic Turkey, 3 ♀, 3.VIII.1951 (H. Bytinski-Salz). This is a variable species in cuticular colour and differs from the related *Osmia* (*Stenosmia*) *flavicornis* F. Mor., *Osmia* (*Stenosmia*) *excisa* F. Mor., *Osmia* (*Stenosmia*) *paralias* sp. nov., in having the anterior basitarsi enlarged. The Turkestanian *Osmia latipes* F. Mor. has the cuticular colour of the abdomen and legs black. The specimens from Israel have the tibiae, tarsi and the apical margin of the clypeus, broadly reddish; abdominal tergites 1 to 3 reddish, remaining tergites black, apical margins yellowish red or abdominal tergites black, apical margins yellowish red. This species is strictly *oligotrophic* and is, rather common at flowers of *Heliotropium* sp., in the light soil areas of Ramat Gan, Beersheba and Wadi Ruaz near Jerusalem.

FERTONELLA

1914, *Perezia*, Ch. Ferton, *Ann. Soc. Entom. France*, **83**, 233.
1920, *Fertonella*, T. D. A. Cockerell, *Ann. Durban Mus.*, **2**, (5), 257.
1943, *Fertonella*, Grace Sandhouse, *Proc. U.S. Nat. Mus.*, **92**, 552.

Cockerell (1920) published his opinion concerning Ferton's parasitic genus *Perezia* as follows: "While on this group I take the opportunity to note that the related Algerian parasitic genus *Perezia*, Ferton, is a homonym of *Perezia*, Leger and Duboscq. (1909). Ferton's genus may take the name *Fertonella*, n. n., type *Fertonella maura* (Ferton)".

Fertonella is a parasitic genus of bees, known only from one female, and has a resemblance to *Osmia*, of the *Osmia papaveris* group. In this genus the ventral scopa is missing, the mandibles are armed with three long and acute teeth, and the antennae are rather long. The labrum is short and the scutellum very little produced. The marginal cell is rounded at the apex; the arolia (pulvilli) are reduced. The abdomen is cylindrical. The *male* is unknown. The only species of this parasitic genus of bees is *Fertonella maura* (Ferton) Ckll., from Algeria.

Bytinskia, gen. nov.

Female.—Similar to *Osmia*; labrum much longer than broad; mandibles long, tridentate, basal tooth short, rather broad, second tooth well separated from the first by a very deep incision and attached to the very long and acutely edged apical tooth; antennae long, twelve jointed; inner side of the eyes parallel. Scutellum plane, not projecting over the postscutellum; marginal cell long, elongate ovate and slightly appendiculate at the middle of the apex, much longer than the distance from its apex to the wing tip, its apex a little away from the wing margin; two submarginal cells, the second receiving both recurrent veins; first submarginal cell slightly longer than the second; jugal lobe of the hind wings shorter than the vannal lobe; arolia (pulvilli) present, moderate in length; claws simple, not bifid. Abdomen red, compact, not cylindrical; punctation of the dorsum of the thorax fine and dense and that of the abdomen very fine; sixth tergite and sternite equally long and broad, not modified or protruding, with the apical margin nearly rounded; ventral scopa missing; apical margins of tergites 1 to 5 and of sternites 2 to 5 with complete thin, entire and transverse white hair bands.

Male.—Similar to the female; antennae longer, with thirteen joints; mandibles bidentate; sixth tergite with a very small basal tooth at each side; apical margin of sternites 1 to 5 with transverse fringes of white hairs, the hairs of the fourth and fifth sternite shorter. The genitalia related to those of *Osmia*. Stipites long and simple, pointed at the apex and not emarginate, longer than the sagittae; volsellae present, somewhat short; sagittae enclosing the spatha.

Genotype: *Bytinskia erythrogastra* sp. nov.

Habits: parasite in the underground nests of *Osmia sordita* R. Benst.

I treat this parasitic genus as distinct from the Algerian parasitic genus *Fertonella*, taking into consideration its longer labrum, the long and plane scutellum, the elongate ovate marginal cell which is slightly appendiculate, the compact abdomen, and the resemblance to its host *Osmia sordita* R. Benst. The *male* of *Bytinskia* has the genitalia related to *Osmia* and apparently its genus was derived from *Osmia*. *Bytinskia* differs from all the members of *Stelidini* in having the stipites of the genitalia not broadened and emarginate at the apex and in many other morphological characters. It differs from the members of *Dioxini* in having distinct pulvilli, and in the very different

form of the scutellum, postscutellum, last tergites and sternites. This new parasitic genus of bees belongs to the subfamily *Osmiinae* (*Megachilidae*) and to the tribe of *Osmiini*.

I have pleasure in naming this new interesting parasitic genus after Dr. H. Bytinski-Salz, Division of Plant Protection, Ministry of Agriculture, Jaffa, Israel.

Bytinskia erythrogastra sp. nov.

1949, *Osmia sordita* G. A. Mavromoustakis, ♀, nec R. Benoist, *Eos*, **25**, 288.

Female.—Length 6 to 7 mm.

Black; mandibles long, tridentate, light yellow red, apex dark reddish brown and with shining white hairs; clypeus convex, shining, densely and finely punctate, with a median longitudinal unpunctate line, apical margin distinctly crenulated; scape black; flagellum yellow red (a little dark above), except the black brown first joint; supraclypeal plate with a longitudinal polished line in the middle; vertex and occiput shining, finely and densely punctate; clypeus, paraocular area, supraclypeal plate and front densely covered with shining white hairs; occiput bordered with short, dense, and erect pale white hairs; cheeks densely covered with short and depressed shining white hairs; vertex with very short pale white hairs. Mesoscutum and scutellum shining, finely and densely punctate, with short pale white hairs not covering the surface, the hairs on the scutellum somewhat longer; rest of the thorax with rather dense shining white hairs; tegulae light yellow brown; propodeum covered with shining white hairs, basal median area dull, very densely and very finely granulate-punctate; legs reddish, except the brownish black coxae and trochanters, with short shining white hairs; hind spurs light yellowish red; wings hyaline, base with the veins yellowish brown, remainder of the veins and the pterostigma black brown. Abdomen shining, light reddish, sixth tergite black; fifth tergite black except a broad light reddish apical margin, or black with the middle of the disc light reddish (*paratype*); first and second tergites very finely and densely punctate; tergites 1 to 5 with complete transverse apical and entirely shining white hair bands interrupted or rubbed off on the anterior tergites (in worn specimens, some *paratypes*); base and sides of the first tergite with erect shining white hairs, the hairs more dense at the sides; tergites 2 to 5 with very thin, very short, somewhat sparse erect white hairs; sixth tergite with similar hairs not covering the surface, apical margin rounded; sternites reddish; sternites 3 to 5 with darkened disc; sixth sternite dark and covered with very short and thin shining white hairs; apical margins of sternites 1 to 5 with thin, transverse and entirely shining white hair bands, the hairs on the fourth and fifth sternites shorter.

Male.—Length 6 to 7 mm.

Similar to the *female*; black; mandibles bidentate, light yellow red, apex dark reddish brown; scape black; flagellum long, first joint (second antennal joint) black brown, remaining joints yellow red, darkened above; second joint of the flagellum somewhat longer than the first and somewhat shorter than the third (seen from above); flagellar joints 3 to 12 longer than broad; clypeus, paraocular area, supraclypeal plate, front, densely covered with shining white hairs; cheeks with dense and short shining white depressed pubescence; occiput bordered with short, erect pale hairs. Mesoscutum and

scutellum with short pale hairs, somewhat longer on scutellum; rest of the thorax densely covered with shining white hairs; tibiae slightly darkened above; legs with shining white hairs. Tergites 1 to 4 light red, fourth tergite with a broad basal darkening on the integument; or tergites 1 to 3 light red, third tergite with a broad basal darkening of the integument (*paratype*), rest of the tergites black; tergites 1 to 5 with complete apical transverse and shining white hair bands, interrupted or rubbed off in worn specimens (*paratype*); disc of the tergites with very short, very sparse and thin hairs; sixth tergite with very short baso-lateral obtusely edged spines, with shining white hairs, apical margin entire; seventh tergite very short and narrow, not protruding over the sixth tergite, slightly emarginate in the middle. Second, third and fifth sternites with the apical margin entire and covered with dense shining white hair bands (the hairs on the fifth shorter and pale in the middle); fourth sternite with the apical margin emarginated in the middle and having a complete pale hair band, white at its sides.

Bat Yam, 1 ♀ (*type*), 14.VI.1952; 1 ♂ (*allotype*), 19.VI.1952. Bat Yam 5.V — 21.VI. Jaffa 1.VI. Ramat Gan, numerous ♂ ♂ ♀ ♀, 12.VI (G. A. Mavromoustakis, H. Bytinski-Salz, P. M. F. Verhoeff), all *paratypes.*

In a newly emerged *female* (*paratype*), the colour of the integument of the abdomen is somewhat dark reddish and the pilosity on the vertex and dorsum of the thorax paler.

DIOXYS

Dioxys ammobius sp. nov.

Female.—Length 6.5 mm.

Black; clypeus very finely and densely punctate, somewhat convex, covered with very thin and very short white hairs, apical margin subcrenulate; mandibles reddish brown; the other parts of the head with short shining white hairs, the hairs on the vertex less dense and those on the cheeks depressed; antennae reddish brown, base of the scape somewhat darkened. Mesoscutum shining, densely and somewhat finely punctate; tegulae light yellowish red; wings semihyaline; pterostigma and veins black brown; postscutellum, sides of propodeum, mesopleura, covered with snowy white hairs; median triangle of propodeum dull; legs reddish with snowy white hairs. Abdomen reddish and shining; first and second tergites somewhat densely and finely punctate, subapical area narrowly more densely and finely punctate; tergites without hairs, apical margin of tergites 1 to 4 with transverse and entire white hair bands; fourth tergite broader than long; fifth tergite longer than broad, apical margin not modified; sixth tergite short, narrow and pointed at the apex (Figure 1); sternites with very short shining white hairs; apical margin of sternites 1 to 4 with complete transverse shining white hair bands.

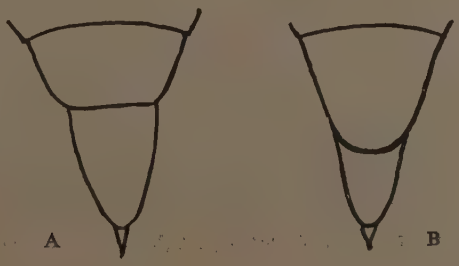

Figure 1
Tergites 4 to 6 of A — **Dioxys ammobius** sp. nov., ♀ ; B — **Paradioxys moricei** Friese, ♀.

Male.—Length 6 mm.

Similar to the *female*; tergites 1 to 5 with transverse and entire shining white hair bands; fifth and sixth tergites with the disc having sparse and very short shining white hairs; sixth tergite short, broader than long but not as long as that of *Paradioxys moricei* Friese. Apical margin narrowly pale; seventh tergite very short, with entire apical margin; sternites 1 to 5 with complete apical, dense and shining white hair bands, disc with very short and somewhat sparse similar hairs.

Bat Yam, 1 ♀ (*type*), 1 ♂ (*allotype*), 14.VI.1952 (G. A. Mavromoustakis); ♂ ♂ ♀ ♀ (*paratypes*), 11.—15.VI.1945 (H. Bytinski-Salz). Jaffa, 11.VI.1945 (H. Bytinski-Salz).

This species is the parasite of *Osmia wahrmani* Mavrom., and was taken by me in a large colony of *Osmia wahrmani* while entering the galleries or hovering above or sitting near the entrance of the galleries.

Dioxys ammobius sp. nov. is related to *Paradioxys moricei* Friese (1899) from Algeria (Biskra), but this species differs as follows:— *Paradioxys moricei* Friese, *female*. Length 6—7 mm. Head and thorax densely covered with shining white, rather thick short hairs, the hairs covering the surface; abdominal tergites 1 to 4 covered also with similar but shorter hairs, apical margins with complete transverse, narrow and white hair bands; fourth and fifth tergites longer than broad, apical margin of the fourth and base of the fifth equally broad; sixth tergite very narrow and very short, a little surpassing the apical margin of fifth and pointed at the apex (Figure 2); sternites 1 to 4 with very short shining white hairs and with complete apical, narrow shining white hair bands.

Male. Length 7 mm. Head, thorax and abdomen densely covered with short, rather thick, shining white hairs, the hairs on tergites 1 to 4 forming complete transverse, apical, shining white hair bands; sternites covered with similar hairs; sixth tergite short, broader than long; fourth sternite with the apical margin very slightly elevated and broadly yellow, without transverse hair band.

Paradioxys moricei Friese belongs to *Dioxys*, and I have examined 4 ♀ of this species from Biskra (Algeria), 9.V.1898 (F. D. Morice), and 1 ♂ from Biskra, 12.V.1898 (F. D. Morice), det. Friese, loaned to me through the kindness of Professor G. Varley, Oxford University Museum.

PRODIOXYS

1914, *Prodioxys* H. Friese, *Stett. Entom. Zeit.*, **75**, 220.

Colour of head and thorax black; abdomen and legs reddish; head and thorax densely covered with erect, rather thick hairs; antennae very thick and rather short; second joint of the flagellum (third antennal joint) a little longer than broad, longer than the first, third or fourth; flagellar joints 3 to 7 broader than long; scutellum and postscutellum as in *Dioxys* (s. str.); first recurrent vein interstitial with the first transverse cubital vein; first cubital cell longer than second; basal vein interstitial with the transverse median vein; marginal cell broadened in the middle, elongate ovate and very slightly appendiculate at the apex, somewhat longer than the distance from its apex to the wing tip, its apex very slightly away from the wing margin; pterostigma small; jugal lobe of hind wings many times smaller than the vannal lobe; pubescence of wings evident and somewhat short.

Prodioxys richardsi, sp. nov.

Female. — Length 10.5 mm, breadth of abdomen 3.5 mm.

Black; head completely covered with somewhat long erect red hairs, those on the vertex somewhat less dense; scape with similar hairs; antennae black; second joint of the flagellum longer than broad, longer than the third or fourth, joints 3 to 7 broader than long, eighth and ninth joints as long as broad, tenth and eleventh joints somewhat longer than broad; vertex and occiput dull, strongly, densely and rugosely punctate; eyes bordered on their outer sides by very short white setae. Mesoscutum dull, densely, strongly rugosely punctate; scutellum and postscutellum as in *Dioxys* (s. str.); mesoscutum and scutellum with dense erect red hairs; the whole thorax covered with similar hairs, except the base of the propodeum in the middle; tegulae red; propodeum dull, with a row of well separated sulci above, their intervals shining. Wings infuscate; marginal cell strongly infuscate; veins brown; pterostigma black brown. Femora black, with red hairs; anterior tibiae black, red at the apex; middle tibiae black, red at the base; hind tibiae red; tarsi red; hind basitarsi narrow and long, longer than the median ones; hind spurs red.

Abdomen red and moderately shining; base of the first tergite, a broad rounded basal mark on the second infuscate; first tergite punctate, sides densely, basal area less densely punctate, subapical area to the very narrow and polished apical margin, very densely and somewhat finely rugose-punctate; third tergite with a basal infuscate mark at each side; fourth and fifth tergites with their basal half infuscate; tergites covered with red, somewhat short hairs forming transverse, dense apical bands of similar hairs; fourth tergite broader than long; fifth tergite long with the base broader than the apex, apical margin truncate and slightly obtuse, protruding in the middle; sixth tergite very short and surpassing in the middle a little the apical margin of the fifth tergite. Sternites not modified and covered with red hairs; apical margin of the sternites with transverse dense red hair bands, the hair band of the second and third sternites whitish in the middle; fifth sternite with its rounded sides slightly elevated to the level of the sixth tergite; sixth sternite very short, narrow, rounded at the apex, longer than broad, densely covered with very short pale hairs and protruding medially in front of the apical margin of the sixth tergite.

Jerusalem—Jericho Road (sea level), 1 ♀ (*type*), 29.III.1943 (H. Bytinski-Salz).

Prodioxys richardsi sp. nov. is the second species belonging to the genus *Prodioxys*. Through the kindness of Professor Bischoff, I have received a sketch of the venation of the anterior wing of the *holotype* of *Prodioxys cinnabarina* Friese (Zoological Museum, Berlin), and in this species the first cubital cell is larger than the second, and the first recurrent vein is interstitial with the first transverse cubital vein.

Prodioxys richardsi sp. nov. differs from *Prodioxys cinnabarina* Friese in many morphological characters. According to Professor Bischoff (i. l.), *Prodioxys cinnabarina* Friese, ♀, has the fourth tergite a little broader than long, the fifth tergite longer than broad, the sixth tergite as broad as the sixth sternite, but the sixth sternite surpasses the sixth tergite. *Prodioxys richardsi* sp. nov. has the fourth tergite much broader than long, the fifth tergite somewhat broader than long at the base, its apical margin truncate and protruding obtusely in the middle, the sixth tergite very short and surpassing a

little the apical margin of the fifth tergite in the middle, the sixth sternite very short and narrow, rounded at the apex, longer than broad, densely covered with very short pale hairs and protruding over the sixth tergite in the middle.

I have the pleasure in naming this interesting parasitic bee after Prof. O. W. Richards, Imperial College of Science and Technology, London.

STELIS

Stelis wahrmani, sp. nov.

Female. — Length 6.5 mm.

Black; mandibles yellow red, deep reddish brown at the apex; clypeus short, broader than long, somewhat convex, shining, strongly and very densely punctate, brown, basal area ochreous yellow, apical margin straight, very slightly elevated and irregularly undulated; supraclypeal plate (area) strongly and very densely punctate, shining. Vertex and occiput shining, strongly and very densely punctate; paraocular area reaching from the sides of the clypeus to the tip of the eyes, ochreous yellow; occiput with ochreous yellow mark at each side; antennal scape and the basal three joints of the flagellum yellow red, remainder of the flagellar joints brown. Head with some very short and sparse white hairs. Mesoscutum shining, very strongly and very densely punctate, with hardly visible very sparse and short white hairs, and a broad ochreous yellow mark anteriorly at each side; scutellum much protruding, rounded, shining, very strongly punctate, disc in the middle of the basal half broadly depressed, apical margin subemarginate in the middle and very broadly ochreous yellow; axillae edentate and ochreous yellow. Tegulae light yellow red, ochreous yellow in front; tubercles, pronotum at each side, mesopleura at each side in front, ochreous yellow. Wings somewhat infuscate, marginal cell infuscate above; pterostigma and veins black brown; first cubital cell smaller than the second; basal vein interstitial with the transverse median vein. Femora light yellowish red and a little darkened at the base; tibiae light yellowish red, light yellow above; tarsi yellowish red, anterior and middle basitarsi light yellowish red, hind basitarsi a little darkened.

Abdomen shining; first and second tergites strongly and very densely punctate, apical margin pale brown (broadly pale at the sides) and very narrowly polished, impunctate and shining; disc black with reddish brown suffusion and a broad ochreous yellow stripe at each side; disc of the third tergite with transverse interrupted cuticular ochreous yellow stripe, base black, subapical area black brown somewhat broadly in the middle and very narrowly towards sides, apical margin very narrowly pale brown; fourth tergite similar in colour but the transverse ochreous yellow stripe notched and slightly interrupted in the middle; fifth tergite with similar colour, but the transverse ochreous yellow stripe notched in the middle and narrowly towards sides; sixth tergite broad, nearly parallel-sided, black, with a lateral ochreous yellow subapical mark, apical margin nearly straight and crenulated, disc with a narrow longitudinal carina, starting from the base and reaching the apical margin; sternites light red.

Male. — Length 5.5 mm.

Similar to the *female*; mandibles with the base black; clypeus entirely black; paraocular area with an ochreous yellow mark reaching from the sides of clypeus to the level of the insertion of the antennae and then narrowing and reaching to the tip of the eyes;

occiput with lateral ochreous yellow marks; antennal scape brown except the apical part. Mesopleura and pronotum without ochreous yellow; scutellum black, the whole disc depressed; colour of the legs similar to the *female*, femora more darkened at the base. Tergites 1 to 3 black, with discal ochreous yellow stripes at sides, that on the third nearly reaching the middle; fourth tergite with discal ochreous yellow stripe at each side of the middle (not reaching the sides) and a sublateral similar spot; fifth tergite black, with a very narrow and short discal stripe at each side but not reaching the edges; sixth tergite not modified and black; seventh tergite black, hidden below the sixth, broad and short, with obtuse sides, with a longitudinal narrow carina, very little protruding above the apical margin in the middle, in the form of a hardly visible point; apical margin of tergites 4 to 6 brown; sternites 1 to 3 black with reddish brown suffusion, apical margin entire and pale (except the first); sternites 4 to 6 deeply depressed, apical margin of the fourth with bright golden hairs covering the whole depression.

Jerusalem, 1 ♀ (*type*), 1 ♂ (*allotype*), 12.V.1951 (J. Wahrman).

This interesting species with greatly protruding scutellum belongs to the subgenus *Protostelis*, having an analogy in the form of its abdomen with *Dianthidium insulare* F. Mor.

Stelis wahrmani sp. nov., with its slightly depressed black disc of the much protruding scutellum, the broad and nearly parallel-sided sixth tergite and its apical margin nearly straight and crenulate (*female*), is not related to any of the known Palaearctic species of *Stelis*.

I have pleasure in naming this interesting parasitic bee after Dr. J. Wahrman, The Hebrew University of Jerusalem.

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NEW ISRAEL APHIDS

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Paczoskia turanica (Nevsky, 1929)

Material of an aphid collected on Compositae (probably *Echinops*) on Mount Carmel, 15.IV.50, by Dr. E. Swirski, was first thought to be a new species of *Dactynotus* Raf., but later was identified as *Paczoskia turanica* (Nevsky). A discussion of this genus would seem to be necessary. It was erected in 1914, without species and in 1919 Mordvilko described as single species *P. paczoskii* n.sp., from *Echinops ritro*. This has a short triangular cauda and in apterae rhinaria over about the whole length of the IIIrd ant. segment. In 1929 Nevsky gave a description of *paczoskii*, which is clearly different. He says that the 45 rhinaria are confined to the basal half of the IIIrd ant. segment, and gives the cauda as 0.41 mm long × 0.13 wide at base, while Mordvilko gave 0.33 long × 0.18 wide at base. Nevsky realized the difference and gave his aphid, from *Echinops karatavicum*, the name *Macrosiphum paczoskii turanicum* nov. subsp. His measurements hold for the material from Israel.

In 1950 Boerner described *Paczoskia major* n.sp. from *Echinops sphaerocephalus*. He says that the apterae viviparae have 50—60 rhinaria on basal $^3/_5$ of IIIrd ant. segment, and that the apices of the siphunculi have 8—10 rows of meshes. A cotypic apterous vivipara in my collection, however, has only 5—7 rows of meshes at the apices of the siphunculi and its IIIrd ant. segment has 35 rhinaria which are confined to basal half, though in an ovipara received from him the 29 rhinaria cover basal $^3/_5$ part of the segment. The material from Israel differs in no way from Boerner's specimens in my collection. The number of rhinaria varies from 28—45 and they are placed on basal $^1/_2$—$^2/_5$ of the segment. I consider *P. major* Boerner, 1950, a synonym of *P. turanica* (Nevsky, 1929).

It should be mentioned here that of the several species which Boerner in 1950 and 1952 places in *Paczoskia* Mordv. only those from *Echinops* belong there. *Paczoskia* is best characterized by the unusual apical segment of the rostrum, which is very long and thin and has a great number of hairs which are not even half as long as the ventral hairs of the body. The first tarsal joints have 5 hairs as in *Dactynotus* Raf., while all the other species which Boerner places in *Paczoskia* have 3 hairs on the first tarsal joints. *P. obtecta* Boerner, 1950, *P. miestingeri* Boerner, 1950, "*P.*" *chamomillae* H.R.L., etc. belong in *Macrosiphoniella* Del Guercio, 1911, unless one wants to keep them separate because the IIIrd ant. segment of the new-born larvae in these larger species has hairs over its whole length (Boerner 1950) while in *Macrosiphoniella* sensu Boerner, 1950, they occur only on distal half. Then they should be placed in *Phalangomyzus* Boerner, 1939.

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Boerner (1952) lists *Tritogenaphis* Oestl., 1922, type *Aphis rudbeckiae* Fitch, as a synonym of *Paczoskia* Mordv. This is quite wrong, not so much because *rudbeckiae* Fitch fits in *Dactynotus* Raf., as Boerner (1930, 1952) understands it, but because *rudbeckiae* Fitch, according to Wilson (1910), is even the same as *Dactynotus hieracium paniculatum* Raf., the genotype of *Dactynotus* Raf., 1818. In 1930 Boerner correctly lists *Tritogenaphis* Oestl. as a synonym of *Dactynotus* Raf.

Ctenocallis israelica n.sp.

APTEROUS VIVIPAROUS FEMALE

Morphological characters

Body oval, about 2 1/4 times as long as its largest width which is near the middle, about 1.57—1.67 mm long, hardly depressed. Head with a median band pigmented, otherwise pale; pronotum sclerotic with a faint median membraneous line; the other tergites with paired, elongated, rectangular, dark brown sclerites, which are mutually free and which leave a rather broad median band spinally membraneous; VIIIth tergite not cleft; all these sclerites strongly wrinkled; between the tergites dotted transverse lines of small intersegmental sclerites. Frons with two blunt tubercles nearly as long as Ist ant. segment, and slightly higher, a pair of more lateral tubercles about half as thick and long as the former; on vertex a row of 4 hardly developed tubercles in a line, the median pair the largest. Pronotum marginally at its posterior corner with a pair of finger-shaped processi, dorsally with 2 pairs of just indicated tubercles. Mesonotum with a pair of similar, slightly larger and more curved processi, with 1—2 spinal pairs of rudimentary tubercles and occasionally with a hardly visible pleural tubercle on anterior half. Metanotum and abdominal segments I to V each with one pair of thin, finger-shaped marginal processi and with a pair of spinal tubercles, which caudad are more developed and often longer than wide; the sclerotic marginal sclerites on which the processi are placed may be free but usually are completely coalesced with the more dorsal sclerites; VIth tergite with much shorter, blunter processi, which on anterior surface near base have the siphuncular porus; VIIth abdominal tergite with 2 pairs of long marginal processi, the bases of which touch, not with spinal tubercles; VIIIth tergite only with two long, basally fused spinal processi directed caudad but diverging on distal part. Each of the processi is paler than the dorsal sclerites, markedly imbricated, abruptly blunt at apex and there usually with an extremely small blunt hair. The spinal tubercles show like paler, wrinkled spots on the anterior segments, but on abdominal tergites IV to VI they become longer caudad and are then often much longer than wide; most of them have a hair similar to that of the marginal processi; only on mesonotum on anterior half two more minute hairs are present pleurally, occasionally on a tubercle. Antennae brown, nearly half as long as body, spinulosely imbricated; Ist segment protracted at inner apex; IIIrd segment a little longer than IVth + Vth, on the middle part with 2—6 slightly transversely oval rhinaria, apparently often hairless; Vth segment longer than IVth; processus terminalis thick, about half as long as the basal part of VIth segment. Rostrum just reaching to the middle coxae; apical segment rather short, only 2/3 of 2nd joint of hind tarsi, with 2 marginal hairs on basal half. Siphunculi mere pores. Cauda strongly knobbed, dark; the knob globular, with 2 long hairs and about 10 shorter hairs. Subanal plate bilobed. Legs rather pale, with rather short,

spiny hairs; tibiae distinctly spinulose towards apex and indistinctly unto near the base; first tarsal joints of all legs with 5 hairs ventrally along distal margin and 2 hairs dorsally; empodial hairs lanceolate.

Colour

Yellowish, with the sclerotic areas brown to blackish brown.

Measurements in mm

No.	*Length body*	*Ant.*	*Siph. proc.*	*Cau.*	*Rhin. on III*	*Ant. segments* III	IV	V	VI
1	1.57	0.75	0.12	0.15	3 & 4	0.24	0.10	0.12	(0.12 + 0.05)
2	1.65	0.78	0.06	0.14	2 & 3	0.24	0.10	0.13	(0.12 + 0.06)
3*	1.61	0.94	0.09	0.16	9 & 10	0.33	0.14	0.15	(0.12 + 0.07)
4	1.60	0.76	0.09	0.14	4 & 6	0.24	0.10	0.12	(0.12 + 0.06)
5	1.67	0.76	0.09	0.14	4 & 4	0.24	0.12	0.12	(0.12 + 0.05)

(*Calycotome villosa*, Rehovot, 21.III.48).

* This is an alatiform aptera with abnormal thorax.

ALATE VIVIPAROUS FEMALE

Morphological characters

Head pale with a median line and areas near the ocelli pigmented, pronotum pale with a median line and two pleural longitudinal brown bands which are continued over the mesonotum; abdomen with the marginal sclerites quite free and the paired spino-pleural sclerites in all respects smaller. The marginal processi much reduced, mostly shorter than wide unto IVth abd. tergite; those on VIth abd. tergite (with the siphuncular pori) often longer than the ones on tergite V and the anterior pair of tergite VII; the posterior pair of VIIth abd. tergite and the mutually free pair on VIIIth abd. tergite still conspicuous and rather darkly pigmented. The spinal tubercles only just recognizable. Antennae nearly 2/3 length of body; IIIrd segment with 6—12 transverse, narrow oval rhinaria in a line, IVth with none. Wings rather narrow, not hyaline, punctated, the veins brown, thick, wavy, faintly bordered; radius only partly indicated, vague; media branched twice; hind wings with 2 oblique veins; very unusual cross-veins may occur irregularly in the fore wings. Other characters as in apterae.

Colour

Brownish-yellow, with the sclerotic areas on abdomen blackish brown and the head and thorax as indicated above.

Measurements in mm

No.	*Length body*	*Ant.*	*Siph. proc.*	*Cau.*	*Rhin. on III*	*Ant. segments* III	IV	V	VI
1	1.36	0.90	0.02	0.14	9 & 9	0.33	0.16	0.19	(0.12 + 0.07)
2	1.43	0.93	0.02	0.15	10 & 12	0.32	0.15	0.15	(0.13 + 0.06)
3	1.21	0.87	0.02	0.12	7 & 8	0.30	0.13	0.16	(0.13 + 0.07)
4	1.49	1.02	0.02	0.14	11 & 11	0.35	0.16	0.17	(0.15 + 0.07)
5	1.61	1.00	0.02	0.13	8 & 10	0.35	0.15	0.16	(0.15 + 0.06)

Discussion

A sample consisting of 5 apterae, larvae and 16 alatae was collected off the leaves of *Calycotome villosa* (Poir.) Link, Rehovot, 21.III.48. The genotype, *Ctenocallis do-*

brovljanskyi Klodn., I saw only mentioned in Mordvilko's keys to Aphids in Tarbinsky and Plaviltchikow's valuable book on the insects of the European part of the USSR. Mordvilko says on p. 207 that it lives on the upper sides of the leaves of *Cytisus biflorus* near Mozyr and Kiev. According to Hegi's flora of Central Europe this plant is a subspecies of *C. ratisbonensis* Schaeffer, as subspec. *biflorus* (l'Hérit em. Koch) Gams.

Boerner says of his *Oniscomyzus* (= *Ctenocallis*) *bramstedti* that it lives on *Cytisus pilosus*, and that it accepts also *C. capitatus*. In Hegi we find *C. pilosus* as *C. hirsutus* L. (= *C. pilosus* Lam.), but also *C. biflorus* sometimes is considered as belonging to *hirsutus*, e.g. as *Cytisus hirsutus* L. subspec. *ratisbonensis* var. *biflorus* Asscherson and Graebner. This shows that the typical hostplants of *dobrovljanskyi* Klodn. and *bramstedti* (Boerner) are extremely nearly related, so that perhaps Boerner's name must be considered a synonym, which is not contradicted by the description.

Of Boerner's species cotypes are at hand. These, like the present species, have hardly developed spinal processi. The apterae differ from those of *israelica* by having much thinner and more curved marginal processi of which those on VIth abd. tergite are subacute, by the practically complete absence of spinal tubercles, by a narrower body with longer antennae and by the basal $^1/_3$—$^3/_7$ part of the hind tibiae having no spinules between the hairs; the hind tibiae of specimens containing embryones, collected 24.VII.41 near Graz by Dr. C. Boerner, mostly show a few pseudosensoria. The only, damaged, alata of *bramstedti* which I have, differs in having the basal $^1/_3$ part of the hind tibiae free of spinules, while in alate *israelica* the basal $^1/_7$—$^1/_5$ has no spinules.

In alate *israelica* the two anterior frontal tubercles are much more protruding than the flattish more lateral ones, but in *bramstedti* all four are similar.

Types

In the author's collection.

Chaitophorus minutus n.sp.

APTEROUS VIVIPAROUS FEMALE

Morphology

Body pyriform, about 0.96—1.16 mm long, about $1^3/_4$—2 times as long as largest width (on caudal half). Tergum sclerotic, but in the available material not or hardly pigmented; abdominal tergites II to VI fused, Ist abdominal tergite more or less free, the VIIth completely free. Only the head and the anterior part of the thorax with more or less distinct bluntish granules, which elsewhere are not distinct. Dorsal hairs all with fine, thin apices, generally very long but as usual with the primary hairs much longer and thicker than the numerous secondary hairs; VIIIth abdominal tergite with 6 hairs about 8 times as long as basal diameter of IIIrd ant. segment on posterior half and with one slightly shorter median hair slightly cephalad of the submedian, longest pair, rarely with some very much finer hairs in an anterior row. Antennae of 5 or 6 segments, about $^3/_5$—$^2/_3$ of the body's length, pale with darker base and apex; proportions of the segments extremely variable (vide measurements); processus terminalis about 2—$2\,^1/_6$ times base of last segment. Hairs on IIIrd segment nearly all on one side at angles of 30—60°, the longest one near the apex of the segment and about $4\,^1/_2$ — 5 times basal diameter of IIIrd segment; the outer side with 1—3 thinner and

shorter hairs which are more adpressed; also on other segments of the flagellum and the basal part of last segment the longest hairs on distal half. IIIrd segment without rhinaria. Rostrum not reaching the hind coxae; apical segment not very blunt, rather slender, about $^{7}/_{8}$—$^{9}/_{10}$ of 2nd joint of hind tarsi, with 2—3 hairs besides the 3 subapical pairs. Siphunculi hardly pigmented, short, about as long as their apical diameter, almost cylindrical, with strongly transverse hexagonal reticulation, with poorly developed flange. Cauda colourless, strongly knobbed, in the constriction about $^{2}/_{7}$—$^{1}/_{4}$ of its width at base, with the knob 1 $^{2}/_{3}$ times as broad and about as long as the diameter of the constriction, with 6—8 longer and shorter hairs. Legs pale, in pigmented specimens with the femora on distal half and the tibiae both at base and apex sometimes darkish to blackish.

Colour

Unknown.

Measurements in mm

No.	*Length body*	*Ant.*	*Siph.*	*Cau.*	*Ant. segments* III	IV	V	VI
1	0.96	0.67	0.04	0.05	0.19	0.06	0.07	(0.09 + 0.17)
2	1.11	0.67	0.04	0.06	0.22	0.09	(0.09+0.18)	
3	1.04	0.63	0.04	0.06	0.14	0.07	0.07	(0.08 + 0.16)
4	1.16	0.76	0.04	0.06	0.18	0.10	0.09	(0.10 + 0.19)

Discussion

A small sample of apterae and larvae was collected from *Salix* sp. near *Degania*, 11.V.43. Owing to an unsuitable pickling fluid the aphids had to be treated for a considerable time with KOH and in this process the integumental pigments were mostly destroyed. Therefore no exact data on the pigmentation are available. One of the larvae shows a dark band on VIIIth abdominal tergite and large dark scleroites at the bases of the hairs on VIIth abdominal tergite, which suggest that also in adults some pigmentation may occur.

In Boerner's 1949 classification of this group the species would come in *Pseudomicrella* Boerner, the type of which is *Aphis vitellinae* Schrank. This classification, however, is very unsatisfactory. *Promicrella* Boerner, 1949 (type *P. ramicola* Boerner, 1949), is separated from *Pseudomicrella* because apterae have the sclerites on the abdominal tergites II to VI not fused to one shield. But examination of large samples of *Promicrella ramicula* showed that that character is an extreme case, and that usually those tergites are more or less, or even completely fused; Boerner's cotypes in my collection are rather recently moulted specimens which always show mutually free tergites. Had they been living for a week more they would have belonged to the genus *Pseudomicrella* Boerner.

A better basis for subdivision is by the direction of the hairs on the segments of the antennal flagellum. In *vitellinae*, *ramicola* and *nassonowi* Mordv., the hairs stand at right angles to the segments and in all directions. In nearly all other species a number of long hairs are directed inwards, while in the other direction only a few much shorter hairs are present. To the latter group *Ch. minutus* n. sp. belongs. Its nearest re-

latives are *Ch. salicti* (Schrank), a nearly always blackish species, and *Ch. truncata* (Hausmann), a usually pale, sometimes darker species, the former on *Salix aurita cinerea* and *caprea*, the latter on *Salix alba, fragilis* and *amygdalina*. They differ, however, by having the last rostral segment very distinctly longer than the 2nd joint of the hind tarsi, the latter measured to its very base and without the claws. In *Ch. minutus* n. sp. the last rostral segment is distinctly shorter than the 2nd joint of the hind tarsi. Besides this there are small differences in pigmentation, in structure of the integumentum and structure of the hairs.

Types

In the author's collection.

Paracletus subnudus n. sp.

NEARLY ADULT LARVA

Morphological characters

Very much like similar larvae of *P. cimiciformis* v. Heyden, but the reticulation of the abdominal integumentum apparently absent. Hairs on body very short, seemingly absent, only on abdominal tergites VII and caudad distinct. Antennae and legs about as in the genotype, but the hairs on ant. segments I to IV very short, about $^1/_{15}$ of basal diameter of IIIrd ant. segment, those on the femora and basal half of the tibiae about as short, but the last ant. segments, the apices of the tibiae and the tarsi with longer hairs.

Colour

Unknown.

Measurements in mm

No.	*Length body*	*Ant.*	*Ant. segments* III	IV	V	VI
1	2.77	0.80	0.16	0.16	0.13	(0.12 + 0.03)
2	2.64	0.77	0.15	0.15	0.13	(0.12 + 0.03)
3	3.00	0.80	0.16	0.16	0.15	(0.13 + 0.03)
4	2.67	0.81	0.16	0.16	0.14	(0.13 + 0.03)

(Larvae, *Hordeum sativum*, Rosh Haniqra, III.51, Harpaz 5207).

Discussion

A sample of 5 nearly adult larvae, collected by Dr. I. Harpaz from the roots of *Hordeum sativum*, near Rosh Haniqra, III.51, was first identified as *Paracletus cimiciformis* v. Heyden, but when I had collected larvae of the latter species the sample from Israel was recognized as belonging to an undescribed species, which differs from *P. cimiciformis* v. Heyden by having very much shorter hairs.

This is the fourth species of *Paracletus* to be described. In 1921 Mordvilko described *P. portschinskyi* n. sp., which is said to differ from *P. cimiciformis* v. Heyden by the apterae having eyes with many facets instead of only three, a different sculpture of the tergum, and hairs which on the tibiae are only $^1/_3$—$^1/_4$ instead of $^1/_2$—$^5/_8$ of the diameter of the hind tibiae. Clearly *P. portschinskyi* is *P. cimiciformis* v. Heyden,

but what Mordvilko's *cimiciformis* is I do not know. That form is not even mentioned in Mordvilko's treatise of Fordini of 1935, though there he also places *portschinskyi* as a synonym of *cimiciformis* v. Heyden.

Theobald in 1927 described *P. donisthorpei* nov. spec. from Sicily. The species is also recorded by Roberti (1939). Dr. J.P. Doncaster of the British Museum (Nat. Hist.) most kindly gave valuable information on last instar larvae present in Theobald's type samples. The hairs on basal half of the hind tibiae are about 0.035 mm, as compared with 0.008 mm in *subnudus* n. sp. *P. donisthorpei* differs from *P. cimiciformis* by the IVth ant. segment in larvae with 6 ant. segments being about twice as long as the IIIrd. The IIIrd ant. segment in *subnudus* and *cimiciformis* is about as long as the IVth.

The minute hairs, which are about 1/4 of the length of those known in other *Paracletus* spp., make the new species easily recognizable.

Types

In the author's collection.

Lachnus swirskii n. sp.

APTEROUS VIVIPAROUS FEMALE

Morphological characters

Body broadly pyriform, about 3.10—3.50 mm long. Abdominal tergum with small dark intersegmental sclerites and with paired sclerites on VIIIth tergite, otherwise membraneous and colourless. Tergite with a fine reticulation of very strongly transverse cells which are partly filled with a finer secondary net of more isodiametric cells; the ridges which compose the cells rather straight and firm. Dorsal hairs very blunt, thick, about 0.013—0.026 mm long, but those on VIIIth abdominal tergite all or partly acute or acuminate and up to 0.06 mm long. Head dorsally with short, blunt hairs, ventrally with longer, acute hairs. Antennae brownish yellow, rather densely faintly imbricated, about 3/7—1/2 length of body; IIIrd segment up to as long as IV + V + VI; IVth and Vth about equally long; VIth about half as long, with the processus terminalis very short, not longer than the diameter of the primary rhinarium on VIth segment. Hairs on IIIrd segment up to 3/4 of the diameter of the segment at their point of insertion, blunt with faintly incrassate apices, standing out at 45° to the long axis of the segment, not very numerous (e.g. about 40 hairs on IIIrd segment). Rostrum about reaching the siphunculi. Mesosternal processi slender, horn-like. Siphunculi on large blackish sclerotic cones, the upper part with numerous long fine hairs like the ventral ones, but near the base of the cones with a few short hairs like the normal dorsal hairs. Cauda about twice as wide as long. Legs brownish yellow with the tibiae darker towards their very apices; tibiae with blunt hairs which gradually lengthen towards the apex of the tibiae, but the hind tibiae on the inner side with long, fine, wavy hairs all of about the same length; first tarsal joints 3/5 of the length of the corresponding second joint without the claws.

Colour *

* According to Mr. Sternlicht reddish-brown.

Measurements in mm

No.	Length body	Ant.	Siph. cones	Cau.	Rhinaria on III	Rhinaria on IV	Rhinaria on V	Ant. segments III	Ant. segments IV	Ant. segments V	Ant. segments VI
1	3.32	1.53	0.36	0.13	1&2	1&1	0&0	0.64	0.26	0.28	0.15
2	3.44	1.50	0.45	0.13	0&?	1&?	0&?	0.61	0.24	0.28	0.14
3	3.13	1.52	0.34	0.11	7&8	4&3	0&0	0.65	0.27	0.26	0.13

ALATE VIVIPAROUS FEMALE

Morphological characters

Head and thorax black sclerotic, but otherwise very much as in the preceding morph. Dorsal hairs slightly thinner and about 20—50% longer. Antennae slightly shorter and thinner but not the VIth segment; hairs on IIIrd segment slightly longer, up to as long as diameter of the segment at the insertion point of the hairs. Siphuncular cones smaller. Legs blackish brown. Wings as in the genotype, *L. roboris* (L.).

Colour

Unknown.

Measurements in mm

No.	Length body	Ant.	Siph. cones	Cau.	Rhinaria on III	Rhinaria on IV	Rhinaria on V	Ant. segments III	Ant. segments IV	Ant. segments V	Ant. segments VI
1	3.51	1.46	0.26	0.12	8&11	2&4	0&0	0.59	0.27	0.27	0.15
2	3.40	1.40	0.26	0.13	10&11	3&2	0&0	0.57	0.23	0.26	0.15

Discussion

3 apterae viviparae and 2 alatae taken by Mr. Sternlicht on *Quercus ithaburensis* Decne, Tiv'on, 4.VII. 54, were received from Dr. Swirski. The species differs from most European *Lachnus* spp. by its short and stumpy dorsal hairs, but in this respect and also in size it agrees with *Lachnus ilicina* (Del Guercio), which may have short and stumpy hairs on the posterior half of the abdominal tergum. However, the hairs on the vertex of *L. ilicina* are fine and acute, and about 4 times as long as those in the new species. In other European species of *Lachnus* sensu stricto the skin of the dorsum shows an extremely fine reticulation, e.g. near the siphunculi, and it is characteristic that the ridges which compose this reticulation are all very strongly sinuated and crooked; superimposed on this minute reticulation is a faint network of elongated meshes, but this also is affected by the same tremor. In *Lachnus swirskii* the various reticulations consist of rather straight ridges.

Types

In the author's collection.

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INSECTS ASSOCIATED WITH DESERT ACACIAS IN ISRAEL

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INTRODUCTION

The two most important desert acacias, *Acacia raddiana* Say (*A. tortilis* Hayne) and *Acacia spirocarpa* Hochst., are the most conspicuous trees in the Wadi 'Araba and its adjacent river beds. Where they occur in larger groups, they give the countryside the aspect of the African tree-savanna. They occur in rather dense formations (several trees per dunam) from Eilat to the shores of the Dead Sea ('Ein Gedi), but single trees occur in the Jordan valley as far as north of Beisan. Towards the West, single trees (probably the remains of a more dense distribution) spot the steppes of the Negev, where they meet near the coast with *A. albida* Del. A fourth species, *A. seyal* Del., has been rediscovered recently (Neumark i. litt.) but no material has been collected from it. The further distribution of *A. raddiana* and *A. spirocarpa* extends along the Red Sea coast to the Sudan, and from there through almost the whole East African savanna. In Egypt they are absent or at least very rare and are replaced in the Nile valley and delta by *A. nilotica* Del., a race of the Sudanian *A. arabica*.

This paper, which should be considered only as a first survey, includes all those insect species which were found feeding in at least one developmental stage on the acacias, but excludes the host of forms — chiefly *Hymenoptera* — which can be caught on *Acacia* blossoms as well as on many other species of spring annuals and perennial flowers in the same locality such as *Retama*, *Haplophyllum*, *Polygonum*, *Pulicaria*, etc.

The majority of the species were found on both *Acacia* species, and if not actually found, should be expected to occur. In Egypt for example many of these species occur on *A. nilotica*, and in the Sahara also on *A. seyal*. Therefore, and because on several samples of wood received the exact species could no longer be established, the specific *Acacia* host has not been indicated.

Localities have also been omitted, as probably all species can be found in every locality where the acacias occur. The majority of the material was collected along the road to Eilat: Kfar Yeroham, Wadi Fuqra, 'Ein Hatseva ('Ein Hosb), 'Ein Yahav, Wadi Gharanda, Wadi Jirafi, 'Ein Radian, Beer Ora, and the wadis above Sdom and 'Ein Gedi.

I am much indebted to Dr. S. Neumark, Entomologist of the Division of Forestry, for a number of specimens from his collection and breedings. The *Buprestidae* were kindly determined by Prof. J. Obenberger and most of the *Coccoidea* by Prof. A. S. Balachowsky. Many other species were determined by several specialists who are mentioned in the list; to all these, my sincerest thanks are due.

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The species not recorded by Bodenheimer (1937) are indicated by an asterisk *. They number 31 out of 50 species and among them are 2 new buprestids and 1 new coccid, which will be described elsewhere by Profs. Obenberger and Balachowsky respectively.

In presenting the insect species in a tabular form, I had to refrain from inserting many interesting bionomical and ecological details which will be published in another context. Regarding the foodplants, species confined to the family *Mimosoidea* (*Acacia* and *Prosopis*) are called monophagous, while those feeding on several plant families are registered as polyphagous (euryphagous). For many species the food plant, *Acacia*, is here recorded for the first time and they are registered as monophagous, though further investigations may reveal food plants also of other families.

Abbreviations: End. = Endemic (species occurring only in Israel); Eth. = Ethiopian; Med. = Mediterranean; Or. = Oriental; Paltrop. = Palaeotropical; SS. = Saharo-Sindian; Mon. = monophagous or stenoecous; Pol. = polyphagous or euryoecous.

TABLES

Insect species	*Food plants*	*Food or ecological valence*	*Distribut.*	*Faunal elem.*	*Remarks*
LEPIDOPTERA					
Lycaenidae					
Jolaus glaucus Btl.[1] (syn. *J. jordanus* Stgr.)	*Acacia*	Mon.	Isr. Arab. Somal.	Eth.	Female observed laying eggs. Not in Egypt.
Azanus jesous Guer. ssp. *gamra* Led.	*Acacia* *Prosopis*	Mon.	Syr. Isr. Arab. Ind. Burma	Or.	In Egypt replaced by *A. jesous* ssp. *jesous*.
Anthene amarah Guer.	*Acacia*	Mon.	Isr. Arab. Sierra Leone, Abyss. to Cape	Eth.	*v.* Graves (1925). Not in Egypt.
Lymantriidae					
Laelia innotata Walk. (syn. *Ocneria flavipalpata* Stgr.)	*Acacia* *Prosopis* *Ochradenus*	Pol.	Isr. Arab. Sin. Egypt, Morocco	SS.	Bred.
Lasiocampidae					
**Chilena obliquata* Klg.	*Acacia* *Prosopis* *Ephedra* *Retama* (Wilts. 1948)	Pol.	Isr. Egypt	SS.	
Anadiasa undata Klg.	*Acacia*	Mon.	Isr. Egypt, Sud. Eth.	Eth.	Not in Arabia.
**Nadiasa acaciae* Klg.	*Acacia*	Mon.	Isr. Egypt, Sudan	Eth.	Not in Arabia(?). Bred.

1. *Virachola livia* Klg., another Lycaenid of Ethiopian origin, feeds in the seed pods of *Acacia farnesiana* and the fruits of *Punica granatum*. It attacks pomegranates as far South as Revivim in the Negev, but I have never raised it from the seed pods of the desert acacias which grow in the vicinity. Perhaps the pods are not juicy enough.

Insect species	*Food plants*	*Food or ecological valence*	*Distribut.*	*Faunal elem.*	*Remarks*
Noctuidae					
Scodionyx mysticus Stgr.	*Acacia*	Mon.	Isr. Egypt	Eth.	
Cortyta acrosticta Pgl.	*Acacia* (Wilts.1948)	Pol.	Isr. Sinai, Egypt	Eth.	Also found in places where acacias do not occur (Jerusalem).
Geometridae					
Coenina dentaria Swinh.	*Acacia* (Wilts.1948)	Mon.	Isr. Arab. Egypt, Eth.	Eth.	
Tephrina disputaria Guen.	*Acacia* (Wilts.1948)	Mon.	Isr. Sin. N. Africa, Cameroons, Iran, India, Burma	Paltrop.	
Cossidae					
Paropta johannes Stgr.	*Acacia*	prob. Pol.	Israel	End.	Larvae found in *Acacia* at 'Ein Gedi; moths were also caught by daylight.
Pyralidae					
Salebria cirtensis Rag.	*Acacia*	Pol.	Israel, N. Africa	SS.	Bred. Defoliator. Recorded by Amsel (1935) also from places where no acacias occur. Det. M. Hering
COLEOPTERA					
Buprestidae					
**Acmaeodera nubica* Obbg.[2]	*Acacia*	Mon.	Isr. "Nubia"	Eth.	Bred. Not in Egypt.
**Ptychomus politus* Klg.	*Acacia*	Mon.	Isr. Sinai, Egypt, Arab. Sud. Eth. Senegal	Eth.	Bred.
**Chalcogenia theryi* Ab.[3]	*Acacia*	Mon.	Isr. Egypt, Alg. Sahar.	Eth.	Bred. Nearly related species in the Sudan and Ethiopia.

2. *Steraspis squamosa* Klg.: Obenberger (1946) writes: "Species in Acaciis in Palestina valde frequens". J. Houska collected this material together with the writer in the tamarisk thickets at the lower Jordan (Allenby bridge, Al Maghtas), Kallia and the Arnon river, where no acacias occur. The species is a true *Tamarix* breeder, but where both species occur together (Wadi Fuqra, 'Ein Hatseva) this beautiful buprestid may sometimes be seen swarming around *Acacia* trees. *Steraspis speciosa* Klg. (Upper Egypt, Sudan, Arabia), which is a true *Acacia* breeder, has not yet been observed in Israel.
3. *Psiloptera mimosae* Klg.: Obenberger (1946) writes: "Species in pratis Acaciorum valde communis". J. Houska collected this material together with me in the Wadi Faria on *Zizyphus* and at the lower Jordan on some desert shrub. The larva probably lives in the roots of *Zygophyllum* and perhaps also *Balanites*. The polyphagous *Psiloptera catenulata* Klg., which also attacks *Acacia* in Egypt, is mentioned by Bodenheimer (1937) for Erez Israel, but I have never seen a specimen. I suspect some synonymic imbroglio.

Insect species	*Food plants*	*Food or ecological valence*	*Distribut.*	*Faunal elem.*	*Remarks*
**Sphenoptera* (*Hoplistura*) *bytinskii* Obbg.	*Acacia*	Mon.(?)	Israel	End.	Many nearly related species in Sin. Egypt, Arab. Alg. I include this species among the *Acacia* feeders with some doubt, as some specimens were also found on *Tamarix* nearby.
Anthaxia moises Obbg.	*Acacia*	Mon.	Isr. Sinai	Eth.	Closely related to *A. angustipennis* Klg. which extends to the Sudan. Bred.
**Anthaxia congregata* Klg.	*Acacia*	Mon.	Isr. Ar. Eg. Somal. Sahar.	Eth.	Bred.
**Diplolophotus deserti* Klg.	*Acacia*	Mon.	Isr. Arab.	Eth.	Bred. Not in Egypt.
**Agrilus lituratus* Klg.	*Acacia*	Mon.	Isr. Egypt, Sud. Sahar.	Eth.	Bred.
**Agrilus bytinskii* Obbg.	*Acacia*	Mon.	Israel	End. (Eth.?)	Bred.
**Agrilus andresi* Obbg.	*Acacia*	Mon.	Isr. Sin. Ar. Hoggar	Eth.	Bred. Not in Egypt. Nearly related species of the *A. discolor* group: Erythrea to Cape.
Bostrychidae					
Enneadesmus forficula Fairm.	*Acacia Citrus*	Pol.	Isr. Sin. Ar. N. Africa, W. and E. Africa	Eth.	Bred.
**Calopertha truncatula* Anc.	*Acacia*	Mon.	Sahara, C. and E. African savanna, Isr. Arab. India	Pal-trop.	Bred. Not in Egypt.
**Sinoxylon ceratoniae* L.	*Acacia*, also *cyanophylla Poinciana Ficus* etc.	Pol.	Isr. Egypt, Sudan to Senegal, Eth. Arab. India	Pal-trop.	Bred. In Israel distributed throughout the country.
Cleridae					
**Tillus senegalensis* Cast.	*Acacia Tamarix*	Pol.	Isr. Sudan, S. Sahara, Senegal	Eth.	Bred. Predator of wood boring larvae; not in Egypt. Det. G. E. Bryant.
**Tillus mediozonatus* Frm.	*Acacia*	Mon.(?)	Isr. Obok, S. Sahara	Eth.	Bred. Predator of wood boring larvae; not in Egypt. Det. G. E. Bryant.
**Cylidrus* prob. nov. spec.	*Acacia*	Mon.(?)	Israel	End. (Eth.)	Bred. In Egypt: *C. angustatus* Pic.. Det. G. E. Bryant.
Coccinellidae					
**Exochomus nigripennis* Er. (*bona spec.*)	*Acacia Ephedra* etc.	Pol.	N. Africa, East Med. Transcasp.	Med.	Predator of scale insects. Det. F. Capra.

Insect species	*Food plants*	*Food or ecological valence*	*Distribut.*	*Faunal elem.*	*Remarks*
Dermestidae					
Attagenus posticalis Frm.	*Acacia*, also on annual flowers	Pol.	Hisp. Alg. Egypt. Isr.	Med.	Bred.
Pharodonoma nobile Rtt.	*Acacia Tamarix*	Pol.	Med. Or. Cyp. Isr. Iraq, Eg.	East Med.	Det. G. E. Bryant.
Scarabaeidae					
**Oryctes boas* F. ssp. *sinaicus* Wlk.	Larva prob. in decaying *Acacia* wood ('Ein Gedi)	Pol.	Israel, Sinai	SS.	Other ssp. of *O. boas:* Arab., Senaar, Iraq, Iran, Sind.
Cerambycidae					
**Crossotus arabicus* Gah.	*Acacia*	Mon.	Isr. C. Arab. Coast, Aden	Eth.	Bred; also from *A. cyanophylla* at Eilat. Not in Egypt. Det. L. Heyrovsky.
**Notophysis rugosiceps* Pic.	*Acacia*	Mon.	Upper Egypt, Israel	Eth.	
Bruchidae					
Pseudopachymerus laillemanti Mars.	*Acacia* seeds	Mon.	Isr. Egypt, Sah. Sud. Senegal	Eth.	Bred; also attacks *A. farnesiana.*
**Bruchidius albonotatus* Pic.	*Acacia* seeds	Mon.	Isr. Sudan, Egypt	Eth.	Bred. Det. G. E. Bryant.
Curculionidae					
**Camptorrhinus erectisquamis* Marsh.	*Acacia*	Mon.	Isr. Arab. Eth. Tang. Kenya	Eth.	Bred from wood; not in Egypt. Det. G. Marshall.
**Sphadasmus maculatus* Houst.	*Acacia*	Mon.	Isr. East Africa	Eth.	Bred from wood. Not in Egypt; in Sinai: *S. sinaiticus* Pic. Det. G. Marshall
HYMENOPTERA					
Formicoidae					
**Tetraponera* (*Sima*) *bifoveolata* Mayr ssp. *syriaca* Wheel.	*Acacia*	Mon.(?)	Isr. Sin.	Eth.	Arborical; not in Egypt. *T. bifoveolata:* Zanzibar, Portug. East Africa.
Crematogaster jehovae For.	*Acacia*	Pol.	Syr. Isr. Sin.	East Med.	Not in Arabia.
**Leptothorax angulatus* Mayr	*Acacia*	Mon.(?)	Isr. Sin. Egypt, Tunis, Uganda, Rhodesia.	Eth.	Arborical; not in Arabia.
Scoliidae					
**Scolia maculata* Drury	*Acacia Quercus Pistacia* etc.	Pol.	E. Medit. Alg. Morocco.	Med.	Parasite of Oryctes. Not in Egypt.
Braconidae					
**Iphiaulax agnata* Kohl	*Acacia*	Mon.	Isr. Arab. Socotra	Eth.	Bred; prob. parasite of *Chalcogenia.* Det. G. Nixon.

Insect species	*Food plants*	*Food or ecological valence*	*Distribut.*	*Faunal elem.*	*Remarks*
DIPTERA					
Syrphidae					
**Eumerus* prob. sp. nova	*Acacia*	prob. Pol.	Israel	End. (SS?)	Larvae breeding in the moist gum of hollow trees; nearly related to *E. cistanchii* Effl. (Isr. Egypt) bred from decaying *Cistanche* flowers. Det. O. Theodor.
COCCOIDEA					
Diaspidae					
**Fulaspis bytinskii* Bal.	*Acacia*	Mon.	Israel	End. (Eth.)	The only other species of this genus, *F. guilliermi* Bal., lives in French Guinea on *Macaranga*.
Pseudotargionia glandulosa Newst.	*Acacia*	Mon.	Isr. Sinai, Eg. Sud. S. Sahara	Eth.	
Lecaniidae					
Ceroplastes africanus Green	*Acacia Tamarix Cassia Clerodendron*	Pol.	Isr. Sin. Eth. Eg. N. Afr. to Cape	SS.	
**Lecanodiaspis africana* Newst.	*Acacia Zizyphus Salix Ficus Casuarina Pisidium Lcawsonia*	Pol.	Isr. Egypt, Sudan, N. Africa	Eth./SS.	
**Coccus elongatus* Sign.	*Aacia Albizzia Tecoma Vitis Citrus Bambusa* and many other trop. plants	Pol.	Isr. Egypt, Sudan and other trop. countries (partially introduced)	Paltrop.	

DISCUSSION

1. *The faunal elements and their ecological valences*

A faunistic-ecological analysis is given in the following table:

	Species	*Ethiop.*	*Orient.+ Palaeotrop.*	*Medit.*	*Sah. Sind.*	*Endemic*
Total:	50	29	5	5	5	6
Monophagous or Stenoecous	33	26	3	—	—	4
Polyphagous or Euryoecous	17	3	2	5	5	2

Of a total of 50 species, 29 are of Ethiopian origin. To this number must be added five palaeotropical species occurring in the Ethiopian region as well as in the Oriental — *Tephrina*, *Calopertha*, *Sinoxylon* and *Coccus*, and perhaps also *Azanus*, which occurs in two not very different subspecies in Africa and India (the Israeli ssp. belongs to the Indian form). Of the endemic species three — *Agrilus*, *Cylidrus*, *Fulapsis*, — show close relationships with Ethiopian species, so that 37 species = 74% may be considered of Ethiopian origin. This is of course not astonishing, as the food plants are also of Ethiopian origin. Of course the dependence on *Acacia* as a food plant varies very much in the different ecological groups, as there are: leaf feeders, species living in decaying wood, wood borers, predators, parasites, and groups like ants, which, though arborical in general, show very loose ecological relations to any specific kind of tree. But if we take the groups which show the closest relationship to the tree, the wood borers, their predators and parasites (*Buprestidae*, *Bostrychidae*, *Cerambycidae*, *Curculionidae*, *Cleridae*, *Braconidae*), we find that of 19 species (*Sphenoptera* excluded as not bred) *all* are of Ethiopian origin. Another characteristic feature of the Ethiopian species is that the majority of them are monophagous on *Acacia*. Of 33 monophagous species 26 are Ethiopian, 3 Palaeotropical or Oriental and 3 endemic species with Ethiopian affinities = 97%.

The Mediterranean element (10%) is represented by 5 polyphagous species: 2 *Dermestidae* which feed on all kinds of insect remains such as dead larvae, skins etc.; a coccinellid, *Exochomus*, which feeds on scale insects in general; an ant, *Crematogaster*, which builds its nest in all kinds of wood; and the *Scolia*, which parasitizes all kinds of scarabaeid grubs large enough for its development. It is possible that *S. maculata*, which is present in all parts of Israel where large deciduous trees occur and where it parasitizes *Oryctes nasicornis* L. ssp. *kuntzeni* Minck and *Promacrurus bimucronatus* Pall., may have crossed over from the *Quercus* and *Pistacia* forests of Transjordan to 'Ein Gedi.

The Saharo-Sindian element (10%) is represented by 5 polyphagous species: 3 leaf feeders among the *Lepidoptera*, *Oryctes boas* — a feeder in decaying wood in the eremic belt of the Eastern deserts, and 2 polyphagous coccids which show Ethiopian affinities (1/2 point each in the table).

Concerning the 6 endemic elements, I have already pointed out that 3 of them show close affinities to Ethiopian species. The occurrence of the genus *Fulaspis* is of special interest, as the only other species known occurs on the west coast of Africa. The Coccid fauna of North Africa is now pretty well known, and therefore this isolated occurrence may point to an old tertiary relic. Whether it is really monophagous remains questionable, as the 2 species feed on entirely different families. Two species, *Sphenoptera* and *Eumerus*, show their nearest relatives in the eremic belt. The second certainly belongs to a very polyphagous genus, the first may feed also on *Tamarix*. The position of the endemic Cossid, *Paropta johannes* Stgr., is difficult to evaluate. In the genus *Paropta* there probably remains only one other species, *P. paradoxus* H.Sch., a polyphagous East Mediterranean species (*P. niloticus* Joann., *P. pharaonis* B. H., *P. henleyi* Roth. from Egypt and probably also *P. frater* Warn. from S. Arabia, are true *Cossus*). But the specific relationship between *P. paradoxa* and *P. johannes* is rather distant, at least as far as it concerns the genitalia. It may be possible that *P. johannes* will also prove to be polyphagous.

2. *Origin and immigration of the Ethiopian faunal element*

It is obvious that the majority, if not all, of the species of Ethiopian origin must have migrated into Israel from the African savanna together with their food plants — the desert acacias. I estimate the time of immigration from the Middle Tertiary to the Late Pleistocene, and the immigration did not occur once but in several waves.

The disjunctive distribution of the ant *Tetraponera* and the coccid *Fulaspis* point to Early Middle Tertiary relics. The palaeotropical genus *Tetraponera* must be very old, as it occurs in several endemic species in Madagascar (which has been severed from the African continent at least since the Early Tertiary) and is known also from the Oligocene Baltic amber. Its presence in the coniferous amber forests supports the view that this ant has not always been associated with *Acacia* but is arborical in general.

Some forms have developed into different species on their way from East Africa — *Anthaxia moises*, *Agrilus andresi* and *Cylidrus spec.* This indicates at least a late Pliocene—Early Pleistocene age. But the majority of species, especially those with a continuous distribution from the Southern Sahara through Sudan or Egypt, Sinai into Israel, may have immigrated only during the Middle or Late Pleistocene.

The ways of the immigration of the Ethiopian and Saharan elements point to the South. An exception may be the Indian *Azanus* ssp., which is also common in the coastal and interior plains of Israel and which may have entered through Syria. It is interesting to note that half of the Ethiopian species mentioned (15 out of 29) are not recorded from Egypt. As the fauna of *Lepidoptera*, *Coleoptera*, *Formicoidea* and *Coccoidea* of Egypt is rather well known, this fact has a reasonable value of reliability. The same is of course not the case for species not recorded from Arabia, the entomofauna of which is almost unknown. But the few species which I have indicated as such belong to groups slightly better known.

The absence of so many species from Egypt can be explained only by the geological history of this country. From early Tertiary times, the Highlands of Erez Israel, Syria, Jordan and Arabia, formed a continuous land mass with the East African high plateaus, while Egypt and part of the Sudan were immersed in a large gulf of the Tethys Sea. And even when the Red Sea graben communicated with the Mediterranean and the Indian Ocean in the Middle Pliocene (Ball 1939), it was probably not a very effective ecological barrier. Ball also points out that, even in the latest Pleistocene (50,000 B.C.), when the Lowlands of Egypt had already emerged, they were separated from the Abyssinian Highlands by a series of inland lakes, especially the huge Lake Sudd which covered the whole Sudanian plain. Only in the late Palaeolithic period, when the climate became drier and these barriers disappeared, *Acacia nilotica* with its Ethiopian fauna was able to migrate into the Nile valley (Wiltshire 1949), while the two other desert acacias had ample time to migrate into Israel via Arabia and Sinai (the Gulf of 'Aqaba certainly is not a faunistic barrier) during Pliocene-Pleistocene times.

In this connection I want to point out again that it is not the difference in the specificity of the *Acacia* which prevented the penetration of *Acacia*-feeding species into the Nile valley, as many of the infesting forms found on *A. raddiana* and *A. spirocarpa* in Israel are known to occur in Egypt and in the Sahara also on *A. nilotica*, *A. seyal*, *A. albida*, *A. gummifera* and even *A. farnesiana*. It seems simply because of the shortness of the period that these species did not penetrate further into the Nile valley. This

assumption is supported by the fact that quite a number of species associated with *Acacia* in the Sahara have reached eastwards only Egypt, and some Egyptian species penetrated into the Sinai, without having been found so far in Israel.

Thus there seems ample belief in the fact that the majority of the species immigrated from the Red Sea coast and from both sides of the Gulf of 'Aqaba into the valley of the 'Araba. Very few immigrants seem to have crossed from Lower Egypt into the Negev. *Salebria cirtana* and *Agrilus lituratus* may be such forms. The majority of the Egyptian *Acacia* feeding species stop at the foot of the high mountain range of the S.W. Sinai, where they are still found in the western wadis but seem unable to cross into the Lowlands of the N. Sinai and the Western Negev.

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ON A COLLECTION OF FLEAS FROM *MICROTUS GUENTHERI*

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In connection with a study of the Levant vole (Bodenheimer 1949), a collection of fleas which we examined was made by Dr. M. Dor. This collection contained the following 3 species: *Ctenophtalmus congener* Roth., 1907 (351 specimens), *Nosopsyllus* (?) *sincerus* J. and R., 1921 (286 specimens), and *Stenoponia tripectinata* Tirab., 1907 (1 specimen).

C. congener was first identified in Israel in connection with a rodent ectoparasite survey carried out in the Department of Parasitology of the Hebrew University. It probably belongs to a new subspecies. *N. sincerus* was described by Jordan and Rothschild (1921) from 2 specimens collected by Aharoni in Rehovot. The specimens found on *Microtus guentheri* seem to belong to the above species, but its position will be defined exactly by comparison with the types in the Tring Museum.

Both *C. congener* and *N.* (?) *sincerus* seem to be specific parasites of *M. guentheri*, while *Stenoponia tripectinata* is a specific parasite of the Gerbillinae and infests *M. guentheri* only accidentally.

The scanty material of parasites of *M. guentheri* in the ectoparasite survey did not permit a detailed study of their seasonal distribution, and I am therefore indebted to Prof. Bodenheimer for placing his material at my disposal.

Most of the voles were caught by killing traps, and all the parasites collected from the voles on the same day were put into one vial. The material collected during February, March and April was unfortunately lost.

TABLE I

The flea indices of N. (?) sincerus *and* C. congener

	Number of voles caught	*Number of voles infested with fleas*	*% of infested voles*	*Total number of fleas*	*Gross flea index*	*Number of fleas per infested voles*	*Specific flea index* Nosopsyllus(?)sincerus			Ctenophtalmus congener		
							No. of fleas	*No. of fleas per vole*	*No. of fleas per inf. vole*	*No. of fleas*	*No. of fleas per vole*	*No. of fleas per inf. vole*
1947												
Aug.	61	13	21.3	29	0.47	2.23	10	0.16	0.77	19	0.31	1.46
Sept.	61	28	45.9	43	0.70	1.53	11	0.18	0.39	32	0.52	1.14
Oct.	57	29	50.9	85	1.50	2.92	24	0.42	0.82	61	1.08	2.10
Nov.	74	42	56.8	166	2.24	3.95	94	1.27	2.24	72	0.97	1.71
Dec.	64	32	50.0	92	1.42	2.88	39	0.61	1.22	53	0.81	1.66
1948												
Jan.	101	68	67.3	173	1.71	2.55	82	0.81	1.21	91	0.90	1.34
Feb.	64	32	50.0									
Mar.	52	19	36.5									
Apr.	62	1	1.6									
May	64	2	3.2	9	0.14	4.50	7	0.11	3.50	2	0.03	1.00
June	49	11	22.4	24	0.49	2.18	9	0.18	0.82	15	0.31	1.36
July	41	13	31.7	16	0.39	1.23	10	0.24	0.77	6	0.15	0.46

Throughout the paper the following terms will be used: Gross flea index = average number of fleas per vole; Specific flea index = average number of fleas of one species per vole.

SEASONAL DISTRIBUTION

The rise of the infestation rate from the end of summer to the maximum in January is clearly shown in Figure 1. 67% of the voles are infested in January and 3% at the lowest point of the curve in May. The maximum of the gross flea index precedes the maximum of infested voles by 2 months. The climax of the gross flea index is in November (2.24) and the low in May (0.14). These figures enables us to explain the build up of the flea infestation in the vole population during the year. At the end of summer the flea population of isolated vole nests or colonies rises. Voles from one nest may be infected with fleas while voles from other nests or colonies, even close by, may be free from parasites. The vole population is more or less stationary in its activity from May to October. Great activity and reproduction begin soon after the first rains, in November or December.

TABLE II

Average vole populations in the 'Emek Yezre'el 1930/41 (*from Bodenheimer*, 1949) (*measured by the number of re-opened holes per dunam*)

Jan.	*Feb.*	*Mar.*	*Apr.*	*May.*	*Jun.*	*July*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
9.2	8.7	8.4	8.1	7.9	6.6	7.1	7.3	7.0	7.0	10.8	11.4

We may assume that during this period of activity the young voles begin to disperse and carry with them the fleas to other parts of the vole population. During this time of expansion the percentage of infested voles rises while the gross flea index declines. This agrees with the views of Cole and Koepke (1947), who state: "a decreasing host population will concentrate the ectoparasites and raise the mean number per rat while an expanding host population will reduce the average counts". Elton (1931), who compares the infestation of rodents with parasites during different years of the cyclical fluctuation in numbers, also states: "For (in certain limits and with certain kinds of parasites) rapid increase in the number of mice in an area will tend to *lower* the average rate of infection, owing to the fact that the proportion of young mice in the population becomes higher and since these numerous young mice carry fewer parasites. The highest rates of infection in *Apodemus* were met with during the winter of 1925/26, when breeding had ceased completely and the population consisted of comparatively few individuals, all adult and many quite old."

Thus Bodenheimer's statement (1949) that the incidence of parasites was high during a year of extreme low vole population is not surprising, and is in accord with the views of Cole and Elton quoted above.

QUANTITATIVE RELATIONSHIP BETWEEN *C. congener* AND *N. sincerus*

Figure 2 shows that there is no great difference in the seasonal distribution of the two species. Both flea populations are at their maximum during winter. The numbers given here do not comprise the whole flea population. Only fleas found on the hosts are included. Fleas found in the nest and free wandering fleas are not considered.

The method by which the material was collected has also to be considered. Fleas were mainly collected from dead voles. Fleas generally leave the dead host after some hours. In summer they are more active and leave the host sooner than during the cold of winter when their movement is more restricted. Figure 2 could therefore represent to some extent the influence of external conditions on the time in which fleas leave the dead rodent. The results obtained in the ectoparasite survey, however, where fleas were collected from live voles, show that this is not correct and that Figure 2 represents in fact the relative size of the flea population during the year.

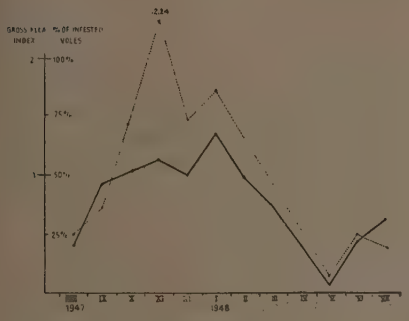

Figure 1

Infestation rate of *M. guentheri* (———) and gross flea index (— — —)

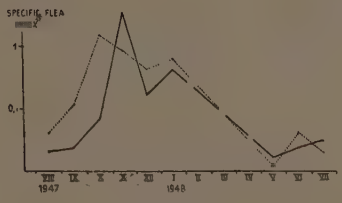

Figure 2

Seasonal distribution of *N.* (?) *sincerus* (———) and *C. congener* (— — —)

The flea population consisted of 55% of *C. congener* and 45% of *N.* (?) *sincerus*. This difference is probably not significant, but the ectoparasite survey showed that *C. congener* is quite specific for the vole (it was never found on any other rodent) while *N.* (?) *sincerus* was found on other rodents in several localities.

SEX RATIO

In most insects studied the natural sex ratio was found to be 1 : 1 or very nearly so. In insects collected in their natural surroundings, deviations from the 1 : 1 sex ratio are found which may be caused by a different life span of the sexes, different behaviour, and different reactions to the varying ecological conditions (Bodenheimer 1952).

It may be assumed therefore that in fleas bred from eggs the natural sex ratio would also be 1 : 1. All sex ratios mentioned in the literature at our disposal, however, deal with fleas recovered from rodents and not with fleas bred from eggs. Cole (1945) gives the sex ratio of *X. cheopis* collected from rats in the U.S.A. He found 36,163 females and 36,283 males, that is a ratio of practically 1 : 1, and concluded that this was the natural sex ratio of *X. cheopis*. He found that during hot days more male fleas are found on the rats and during cold days female fleas are more abundant. He also found that the number of male fleas on the host varies more than the number of females.

TABLE III

Sex ratio of N. (?) sincerus *and* C. congener *on* Microtus guentheri

		Aug.	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May.*	*Jun.*	*July*
N. (?) sincerus	male	4	2	7	37	18	46				1	3	5
	female	6	9	17	57	21	36				6	6	5
	% of males			29	39	46	57						
C. congener	male	15	24	31	37	25	53				2	11	4
	female	4	8	30	35	28	38					4	2
	% of males	79	75	52	51	47	58						

The percentage of males in *N.* (?) *sincerus* is about 47% and in the months in which the figures are relatively large there are more females than males. In *C. congener* about 58% are males. In some months males are more numerous than females, while in others the ratio is practically 1 : 1. The loss of the material of February to April and the small number of fleas caught at the beginning and at the end of the year do not permit a statistical analysis of the seasonal fluctuation of the ratio.

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WATER STABILITY OF CRD-186 TREATED SOILS, AS INFLUENCED BY LEACHING

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INTRODUCTION

In a previous paper (Hagin and Bodman 1954) the soil-aggregate stabilizing effects of Monsanto "Krilium" CRD-186 (calcium carboxylate of vinyl acetate maleic acid — VAMA), a polyelectrolyte soil conditioner, was decribed. An attempt was also made to explain the mechanism of its influence. It was concluded that the aggregate-stabilizing action of CRD-186 is due to a surface reaction between the soil particles and polymer molecules, and that no ion-exchange mechanism is involved in the reaction.

In connection with the findings described in the above-mentioned paper it was considered of interest to determine whether various salt solutions, acting as ion exchange agents, have an influence on the stability of the conditioner treated soils. From the same experiments it was possible to draw some conclusions concerning the influence of working soils while in a wet state upon the water stability of their aggregates.

MATERIALS AND METHODS

Two soils were used in the experiments described. Soil from Rehovot, a sandy soil, low in organic matter and free from calcium carbonate; and soil from Ramat David, a heavy clay soil, with a fairly low organic matter and calcium carbonate content. The amount of water retained by the two soils against a pressure of $^1/_3$ atmosphere (Richards and Fireman 1943) was 5.5 per cent and 42.0 per cent respectively.

25 g of each soil were placed on Buchner funnels in a layer 1.5 cm thick. CRD-186 solutions were applied in such amounts as to supply 25 mg of CRD-186 per sample (0.1 %). The volumes of the solutions were adjusted to the water-holding capacity at $^1/_3$ atmosphere of the treated soils. After the CRD-186 solution was applied, the samples were allowed to stand covered for 24 hours, then leached with 250 cc of neutral, 1N salt solutions, respectively with the same amount of distilled water, or in still other cases they were not leached at all after application of the CRD-186 solution. The check treatment received distilled water only, instead of the CRD-186 solution.

Another set of soils was wetted in a dish with CRD-186 solution or distilled water, and mixed by a spatula while the solution or water were added gradually.

All the samples were air-dried after treatment, and then subjected to analysis of water-stable aggregates by a modification of Yoder's method (1936).

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RESULTS AND DISCUSSION

In Tables I and II the water stability of aggregates in the variously treated soils is expressed as the per cent of water-stable aggregates larger than 1 mm and larger than 0.25 mm, calculated on the basis of the total weight of soil.

As may be seen from Tables I and II, leaching of the soils by the three solutions chosen did not change their aggregation greatly. This holds for the coarse, as well as for the fine textured soil. These results tend to confirm the conclusions drawn elsewhere (Hagin and Bodman 1954). The ions involved were unable to exchange with the CRD-186 and permit its removal by leaching from the treated soils, as judged by the water-stable aggregates analysis. This fact is in accordance with the previous conclusion that the polymer molecules do not come into contact with the soil particles by ion exchange mechanisms, and the possibility of a surface reaction between the soil colloids and the organic polymer, other than that involved in the ion exchange, is suggested.

TABLE I

Water-stable aggregates in soil from Rehovot, treated with CRD-186 and leached.

Treatment	*Leaching solution*	*Size of aggregates* > 1 *mm* %	> 0.25 *mm* %
H_2O	None	0.0	16.5
CRD-186 solution	None	38.2	65.6
	H_2O	45.8	64.8
	$BaCl_2$	52.4	64.1
	CH_3COONH_4	58.2	66.5
	K_2HPO_4	51.0	62.7

Another aspect of the influence of conditioners on soil samples was revealed in these experiments. By comparing the results of water-stable aggregates analyses of soil samples which were mixed by spatula during the wetting procedure with those tabulated in Tables I and II, where the solutions were applied without any mixing, one can see the influence of working the soil sample upon the water stability of its aggregates.

TABLE II

Water-stable aggregates in soil from Ramat David, treated with CRD-186 and leached.

Treatment	*Leaching solution*	*Size of aggregates* > 1 *mm* %	> 0.25 *mm* %
H_2O	None	6.8	30.1
CRD-186 solution	None	40.0	52.1
	H_2O	42.8	62.0
	$BaCl_2$	43.8	60.2
	CH_3COONH_4	42.4	64.3
	K_2HPO_4	40.3	59.9

To clarify the issue, the above mentioned comparison is presented in Table III.

It may be seen from Table III that working generally increases aggregation, and especially in the case of CRD-186 treated soils. However, it also seems that leaching by itself slightly improves the aggregation of the treated soils, which becomes evident upon examination of Tables I and II.

TABLE III

Effect of different methods of application of solutions on amount of water-stable aggregates in soil.

Soil	*Treatment*		*Size of aggregates*	
	Wetting	*Mixing*	> 1 *mm* %	> 0.25 *mm* %
Rehovot	H_2O	No	0.0	16.5
	CRD-186 solution	No	38.2	65.6
	H_2O	Yes	1.6	14.2
	CRD-186 solution	Yes	93.0	98.5
Ramat David	H_2O	No	6.8	30.1
	CRD-186 solution	No	40.0	52.1
	H_2O	Yes	10.2	74.9
	CRD-186 solution	Yes	75.0	93.4

SUMMARY AND CONCLUSIONS

Two soils, one coarse textured, from Rehovot, and one fine textured, from Ramat David, were used in the present experiment.

To the soil samples a solution of CRD-186, a soil conditioner, was applied and the samples were leached subsequently by various salt solutions.

According to water-stable aggregate analyses performed, leaching of treated soils by salt solutions did not induce changes in the water stability of their aggregates. It was found that the results are in accordance with those obtained in a previous work and thus tend to confirm that bonds between soil particles and polymer molecules are not of an ion exchange character.

Furthermore, soils which were mixed during the process of wetting had better water stability than unmixed samples. It may be concluded that working the soil after conditioner application would improve aggregation.

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THE EFFECT OF ISRAELI CLIMATIC CONDITIONS AND SOILS UPON THE FREE AND TOTAL β-AMYLASE OF THREE VARIETIES OF BARLEY *

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The barley kernel contains β-amylase, α-amylase, and amylo-phosphatase. The resting kernel contains mainly β-amylase; the other amylases are found only in very small amounts and are liberated or produced during the germination of the kernel.

K. Myrbaeck and B. Oertenblad (1937—38) and K. Myrbaeck and S. Myrbaeck (1933) found in the resting barley kernel 30—50% β-amylase in soluble form and the rest in bound form.

J. S. Ford and J. M. Guthrie (1908) found that papain is a very active protease in liberating the bound form. β-Amylase is also liberated by such compounds as H_2S, which stimulate the action of the proteolytic enzymes present in the resting kernel (T. Chrzaszcz and J. Ianicki, 1936).

K. Myrbaeck (1936—37) and others showed that the amount of β-amylase is a varietal characteristic.

D. H. Nelson and A. D. Dickson (1942) and H. R. Sallans and J. A. Anderson (1938) found that the total amount and the percentage of free β-amylase vary with the variety and the growing conditions. On the other hand, T. Chrzaszcz and J. Savicki (1937) did not find any relationship between the variety of barley and the amount of β-amylase in it.

The aim of this work was to investigate the total amount and percentage of free β-amylase in the various barley varieties and the influence of climate and soils on the β-amylase content.

Three six-rowed varieties of barley, B.M.C., Gvatith, and M-38, were grown during two seasons (1945—46, 1946—47) in four locations: Ayeleth Hashahar in Eastern Galilee, Gvath in the Esdraelon Valley, Hulda in the south and Doroth in the far south of the country.

The soils ranged between the clay and the clay-loam type, and the climatic conditions, especially rainfall, varied from location to location (Table I).

The rainfall distribution over the growing months of the season was very different during the two seasons. During the 1945—46 season the rainfall distribution was very advantageous; a high percentage of the total amount fell during November, December and February. During the 1946—47 season the rain distribution was very erratic; the rains started late in the season; about 80% fell during December and January; only 20% during February and May, particularly in the southern areas of the country in Hulda and Doroth.

* This is a part of a Dissertation submitted to the Senate of The Hebrew University of Jerusalem in fulfilment of the requirements for the degree of Doctor of Philosophy.
This work was carried out under the supervision of Dr. M. Plaut, Professor of Agronomy and Plant Breeding, Hebrew University. The author is greatly indebted to Professor Plaut for his helpful advice.

TABLE I

Monthly rain distribution in mm during the growing seasons 1945—46 *and* 1946—47 (*Ashbel* 1947, 1948)

	Gvath		*Ayeleth Hashahar*		*Hulda*		*Doroth*	
	1945—46	1946—47	1945—46	1946—47	1945—46	1946—47	1945—46	1946—47*
November	54.0	—	68.0	—	99.6	—	43.0	5.0
December	132.5	126.0	42.0	62.6	140.5	77.7	45.0	38.0
January	12.5	160.5	19.0	195.2	39.7	121.1	49.0	31.5
February	145.5	26.5	116.3	24.6	144.2	8.0	91.0	5.0
March	34.5	23.0	30.9	34.5	28.8	34.8	35.0	41.0
April	—	15.5	—	5.0	—	6.5	—	4.8
May	28.5	4.0	24.2	15.8	21.5	—	7.5	3.5
Total	407.5	353.5	300.6	338.2	474.3	249.2	270.5	128.7

* The very low amount of rain here during this season resulted in complete failure in yield of kernels.

The experiments in the field were laid out in four replications at random. The area of each replication was 100 m². A sample of 2 kg was taken from each replication and passed through a 2 mm sieve; the kernels larger than 2 mm constituted the basic sample for analysis. The samples were ground until they passed through a 1 mm sieve and then ground with clean sand to a very fine and uniform flour. For each replicate in the field two replicates were made in the laboratory.

The amount of free and total β-amylase was determined by the official method of the Am. Soc. of Brewing Chem. (1944) and with modifications suggested by H. R. Sallans and J. A. Anderson (1938).

The results were analysed statistically according to the method of D. D. Paterson (1939).

A. *Free β-amylase (free saccharifying activity)*

The results of the 1945—46 season are presented in Table II. There are highly significant differences in the amount of free β-amylase among the three varieties of barley and the four locations tested.

TABLE II

Average free β-amylase in maltose equivalent in dry matter for varieties and locations in the yield of the* 1945—46 *season*

Location	*Variety*			*Location average*	*Difference between location averages*
	B.M.C.	*Gvatith*	*M-38*		
Ayeleth Hashahar	288.1	154.3	107.9	183.43	11.07**
Gvath	250.4	131.3	135.4	172.36	39.63**
Hulda	218.3	95.3	84.6	132.73	26.86**
Doroth	153.9	88.2	75.5	105.87	
Variety aver.	227.6	117.2	100.8	148.60	
Difference between aver.		110.4**	16.4**		

* g reducing substances, calculated as maltose, that are produced by 100 g barley flour in ½ hr. digestion of soluble starch at 20°C.

** significant at 1% level.

The results for the 1946—47 growing season are presented in Table III. The average values for varieties obtained in the 1946—47 season are similar to those of the preceding season.

TABLE III

Free β-amylase in maltose equivalent in dry matter, average for varieties and locations in the yield of the 1946—47 season

Location	*Variety*			*Location average*	*Difference between location averages*
	B.M.C.	*Gvatith*	*M-38*		
Hulda	356.5	221.2	129.6	238.8	58.4**
Ayeleth Hashahar	267.4	153.8	120.1	180.4	29.8**
Gvath	263.2	142.8	45.8	150.6	
Variety aver.	298.7	172.6	98.5	189.9	
Difference between aver.	126.1**	74.1**			

The statistical analyses of the results of the two growing seasons show that the amount of free β-amylase in barley depends upon the variety, the growing conditions, and particularly on the climatic conditions. The two growing seasons differed mainly by the amount of rain and its distribution. It can be seen that dry spells increase the amount of free β-amylase in the barley, as can be deduced from the higher values obtained for the dryer 1946—47 season at Hulda.

B. *Total β-amylase (total saccharifying activity)*

The results obtained for the two growing seasons, as presented in Tables IV and V, show clearly that the amount of total β-amylase is a varietal characteristic, and that it is affected by the type of soil and the growing conditions prevailing at the different locations and also by the climatic conditions. The "variance" for the three factors is highly significant; it is largest for varieties, followed by the "variances" for years and locations.

TABLE IV

Total β-amylase in maltose equivalent in dry matter, average for varieties and locations in the yield of the 1945—46 season

Location	*Variety*			*Location average*	*Difference between averages*
	B.M.C.	*M-38*	*Gvatith*		
Ayeleth Hashahar	587.6	395.6	264.8	416.0	32.5**
Gvath	511.5	397.6	241.4	383.5	41.3**
Hulda	512.6	298.7	215.1	342.2	96.2**
Doroth	365.2	216.7	156.2	246.0	
Variety aver.	494.2	327.1	219.4	346.9	
Difference between aver.	167.1**	107.7**			

TABLE V

Total β-amylase in maltose equivalent in dry matter, average for varieties and locations in the yield of the 1946—47 season

Location	*Variety*			*Location average*	*Differences between location averages*
	B.M.C.	*M-38*	*Gvatith*		
Hulda	757.7	685.5	461.2	634.8	
					183.5**
Gvath	550.2	436.9	367.0	451.3	
					16.4
Ayeleth Hashahar	533.1	410.6	361.1	435.0	
Variety aver.	613.7	511.0	396.4	507.0	
Difference between aver.	102.7**	114.6**			

It was found that, among the climatic conditions, the amount of rain and particularly its distribution over the growing season cause the main differences in the amount of total β-amylase.

Adequate moisture supply during the first period of the barley plant development and inadequate moisture supply during the stalk and ear development period increase the β-amylase in the kernel.

The difference of 126.5 Malt. Equi. of total β-amylase between the averages of the two seasons is mainly due to the large difference in the kernel weight: 57.4 mg average per kernel for the 1945—46 season and 45.9 mg average for the 1946—47 season. Expressing the amount of β-amylase in grams maltose per 1000 kernel weight it is found that the average for both seasons is almost equal: 221.46 g maltose (1945—46) and 227.4 g maltose (1946—47). The increase in the amount of total β-amylase in a dry season as compared with the amount in a more rainy season is relative only.

An almost equal amount of total β-amylase for both seasons, expressed in grams maltose per 1000 kernel weight, may be explained as follows: J. G. Dickson and H. L. Shands (1941) showed that most of the enzyme systems, and the amylases among them, have their origin in the epithelial layer of the scutellum. It is well known that the embryo and the adjoining structures develop during two weeks following pollination, which in this area occurs around the middle of March. During the two growing seasons the moisture supply was adequate during the first part of the season and, therefore, the development of the embryo and of the adjoining tissues and the secreting of the enzymes proceeded normally and the amount of total β-amylase per kernel was almost equal in both seasons. But during the 1945—46 season, the moisture supply was also sufficient during the second part of the growing season and enabled the assimilation and storage of a large ratio of starch in the kernel (55%); the moisture supply during the second part of the 1946—47 season was inadequate for starch assimilation and storage in the kernel (50.5%) and, as a result, the amount of total β-amylase was relatively higher than in the preceding season.

The above applies also to free β-amylase. There is no clear intervarietal relationship between the ratio of free and total β-amylase; Gvatith contains a higher amount of free β-amylase than M-38, and M-38 contains a higher amount of total β-amylase than Gvatith.

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A Convenient Method for the Preparation of Glycylglycine

The usual method for the preparation of glycylglycine[1], i.e. opening the 2:5-diketopiperazine with sodium hydroxide, gives comparatively small yields of the dipeptide, because repeated recrystallizations from water are required to obtain a product free from sodium chloride. It was found that the yield of glycylglycine could be markedly improved by substituting lithium hydroxide for sodium hydroxide in this procedure.

Five g of glycine anhydride were shaken for 20 minutes with 50 ml of normal lithium hydroxide. To the clear solution an equivalent amount of normal hydrochloric acid was added, and the solution was evaporated to dryness in vacuo. The residue was treated with absolute alcohol, filtered by suction, and was washed repeatedly with cold absolute alcohol. The dried material thus obtained was dissolved in a minimum of cold water and re-precipitated with 10 volumes of absolute alcohol. This process was repeated until a product free of chlorine was obtained. Yield 4.1—4.5 g. For analysis the substance was dried in vacuo over phosphorus pentoxide at 100°. (*Anal.* Found: N, 21.3 (Kjeldahl). Calculated for $C_4H_8N_2O_3$: N, 21.2. Linderstroem-Lang titration: 34.2 mg required 2.57 ml 0.1 N alcoholic HCl, calculated 2.59 ml. Willstaetter-Waldschmidt-Leitz titration: 45.2 mg required 3.44 ml 0.1 N alcoholic KOH, calculated 3.40 ml).

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Determination of Fluorine in Organic Fluoro-Compounds

The determination of fluorine in organic compounds is beset with unusual difficulties. This is evidenced by the large number of publications which have appeared in recent years on this subject. After the successful solution of the problem of the determination of carbon and hydrogen in organic fluoro-compounds[1], an accurate method for the determination of fluorine has now been worked out, which is also applicable to semi-micro quantities (20—60 mg).

The method of choice for the transformation of the organically bound fluorine into fluoride ion proved to be the combustion of the organic compound with sodium peroxide (PARR-bomb)[2] and sucrose as combustion aid; addition of an accelerator, such as potassium perchlorate, was in most cases advantageous. The main difficulty, however, was the determination of the fluoride ion in the resulting product, which contains very large quantities of sodium ion. The distillation of the hydrofluoric acid from this mixture (after acidification)[3] proved to be erratic, especially when the total quantity of the fluoride ion was small. It wal found that the determination of the fluoride ios became both easy and reliable when the solution to be analysed was passed through an acid *cation exchanger* (Amberlite IR-112). The determination was then carried out by the usual titration, using thorium nitrate solution and sodium alizarine-sulphonate as indicator[4].

The method is applicable also to compounds which contain other halogens in addition to fluorine; chlorine and bromine have been determined in the same solution, resulting from the combustion of the substance with sodium peroxide. Obviously, in such a case the addition of potassium perchlorate as combustion accelerator is not indicated.

The following table summarizes some representative results.

TABLE

Compound	*Formula*	*mg F⁻, calc.*	*mg F⁻, found*	*% error*
Fluoroacetamide	C_2H_4ONF	8.88	8.81	0.8
4-Fluoro-biphenyl	$C_{12}H_9F$	6.10	6.15	0.7
3-Nitro-ω-fluoro-acetophenone	$C_8H_6O_3NF$	5.43	5.46	0.6
Phenyl-fluoromethyl-carbinol	C_8H_9OF	4.65	4.68	0.6
o-Fluoro-triphenyl-methane	$C_{19}H_{15}F$	3.09	3.075	0.5
o-Fluoro-triphenyl-chloromethane	$C_{19}H_{14}ClF$	4.47	4.45	0.5
Benz-*p*-fluoroanilide	$C_{13}H_{10}ONF$	3.75	3.74	0.3
Methyl fluoropyruvate	$C_4H_5O_3F$	5.03	5.00	0.6
1,1-Di-(*p*-bromo-phenyl)-2,2,2-tri-fluoro-ethane	$C_{14}H_9Br_2F_3$	14.46	14.34	0.8

The authors wish to express their gratitude to Dr. W. Bodenheimer for his helpful suggestions, and to Messrs. Rohm & Haas, Philadelphia, and their representatives in Israel, Messrs. "Hadbarah" Ltd., Tel Aviv, for the samples of Amberlite used in this study, details of which will be published elsewhere.

This investigation was carried out under the auspices of the Scientific Department, Israel Ministry of Defence, and is published with its permission.

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The Antibacterial Action of Spermidine*

Spermidine is chemically closely related to spermine, and is found together with the latter in various body tissues.

The antibacterial action of spermine has been previously described[1]. The effect of spermidine on bacterial growth in comparison to that of spermine is reported in the present communication.

MATERIALS AND METHODS

Spermidine phosphate and spermine tetrahydrochloride (Hoffmann-La Roche) were used. *Staphylococcus aureus* 23 was the main test organism. Antibacterial assays of spermidine were made by serial dilution in Difco nutrient broth, as described previously[1]. Comparative assays with spermine, and controls containing neither of these substances, were run simultaneously.

RESULTS

Spermidine inhibited the growth of *Staphylococcus aureus* but was less effective than spermine. The antibacterial effect of spermidine rose, like that of spermine, with increase of the pH of the medium (Figure 1). At pH 6.2, 1.8×10^{-3} M spermidine (1000 μg/ml spermidine phosphate), and at pH 8.5, 2.8×10^{-5}M spermidine (15 μg/ml spermidine phosphate), were required to inhibit the growth of *Staphylococcus aureus* completely. The same change in pH from 6.2 to 8.5 increased the activity of spermidine 66 times as against 250 times for spermine (Figure 1). From Figure 1 it may be seen that the ratio of the activity of spermine as compared with that of spermidine increased from 1.25:1 at pH 6.2 to 5:1 at pH 8.5. The higher basicity of spermine may have been responsible for this stronger antibacterial effect. Similar dependence of the antibacterial activity of spermidine and spermine on the pH of the medium was observed also with *Neisseria catarrhalis*.

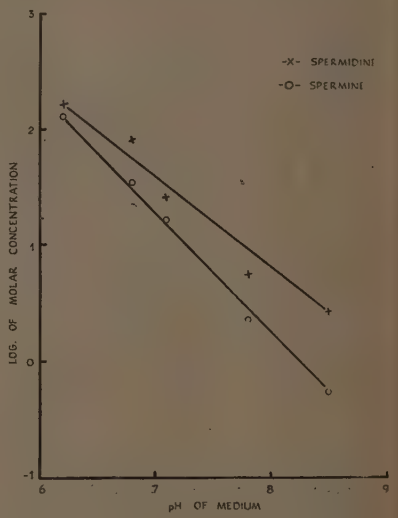

Figure 1

Minimal concentration of spermidine and spermine inhibiting the growth of *Staphylococcus aureus* at various pH values of the medium.

Size of inoculum c.104 cells/ml. Medium: Difco nutrient broth. Results read after 24 hrs. incubation at 37°. Inhibition i.e. no visible growth.

Spermidine, like spermine, was found to be bactericidal and the effect could be demonstrated even at 6°, i.e. against non-multiplying organisms. In experiments with *Staphylococci* (Figure 2) 82% and 76% respectively of the bacterial population were killed in 6 hrs. by 4.8×10^{-4}M spermidine (266 μg/ml spermidine phosphate) and 2.4×10^{-4} M spermidine. After 24 hrs. 2% and 6% respectively remained alive (Figure 2).

The antibacterial spectrum of spermidine, also was similar to that of spermine. *Staphylococci* and *Neisseriae* were most susceptible. *Bacillus anthracis* was less sensitive and organisms of the *Enterobacteriaceae* group were resistant.

* This study was aided by a grant from Hadassah Medical Organization Research Fund.

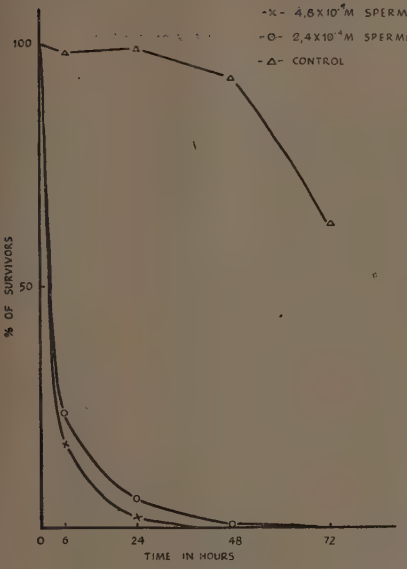

Figure 2

Effect of spermidine on *Staphylococcus aureus* in Difco nutrient broth, pH 7.7 at 6°.

Number of viable organisms determined by the plate count technique. Number of organisms at zero time 4x10⁴. Control, i.e. broth without spermidine.

We wish to thank Messrs. Hoffmann-La Roche, Basle, for kindly supplying the spermine and spermidine.

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The Life-history of Chromaphis juglandicola Kltb. (Aphidoidea, Homop.) in Israel

These aphids are found on the lower sides of leaves of *Juglans regia*[1]. They reproduce parthenogenetically throughout spring, summer and early autumn (*alatae viviparae* and their larvae appear, *apterae viviparae* absent). Sexuals appear in November—December[2]. The eggs laid by the oviparous females hatch in April.

TABLE I

Fluctuations in the population of Chromaphis juglandicola *on walnut in Miqve Israel*

Month	*No. of aphids on 100 leaves*	*% of infested leaves*
1949		
September	2	1
October	10	4
November	83	12
1950		
January-February	No leaves,	eggs on twigs
March	0	0
April	0.6	0.2
May	750	70
June	600	60
July	41	16
August	17	9
September	70	20
October	16	12
November	7	5
December	0.4	0.4
1951		
January-February	No leaves,	eggs on twigs
March	0	0
April	1	1
May	15	8

In the Coastal Plain, the aphids are abundant in late spring and early summer, less so in early autumn. *Retithrips syriacus* Mayet appears in large numbers and competes with the aphids, since leaves visited by the *Retithrips* are rendered unsuitable as food for the aphids. The damage done to walnut trees in Miqveh Israel during the years 1949-1951 was moderate.

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Received November 12, 1954.

The Body Temperature and Cardio-Respiratory Activities of Shorn and Unshorn Awassi Sheep*

Within the framework of the research carried out in many countries concerning the factors influencing adaptability of farm animals to environmental conditions, the effect of the coat-cover on body heat balance is of particular interest[1,2,6].

Levek[5] found that shorn lambs showed greater daily gains than unshorn animals. Fletcher and Reid[3] demonstrated that on hot summer days (36°C at noon) the body temperature and respiration rate of shorn lambs were lower than those of the unshorn. Lee[4] found that, while shorn sheep were at an advantage when the

* Part of a progress report carried out under the guidance of Drs. R. Volcani and J. Magnes in partial fulfilment of the requirements for the Ph.D. degree in the Hebrew University of Jerusalem.

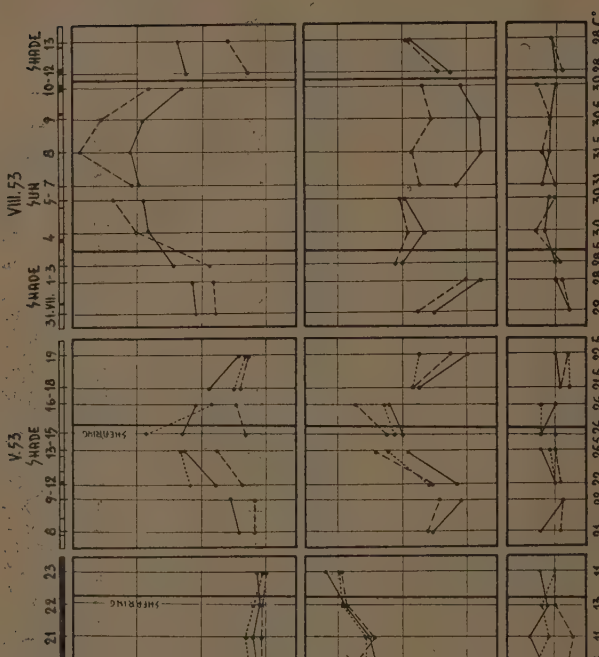

Figure 1

Diurnal trends of body temperature, respiration rate and pulse rate in shorn and unshorn sheep during various experimental periods.

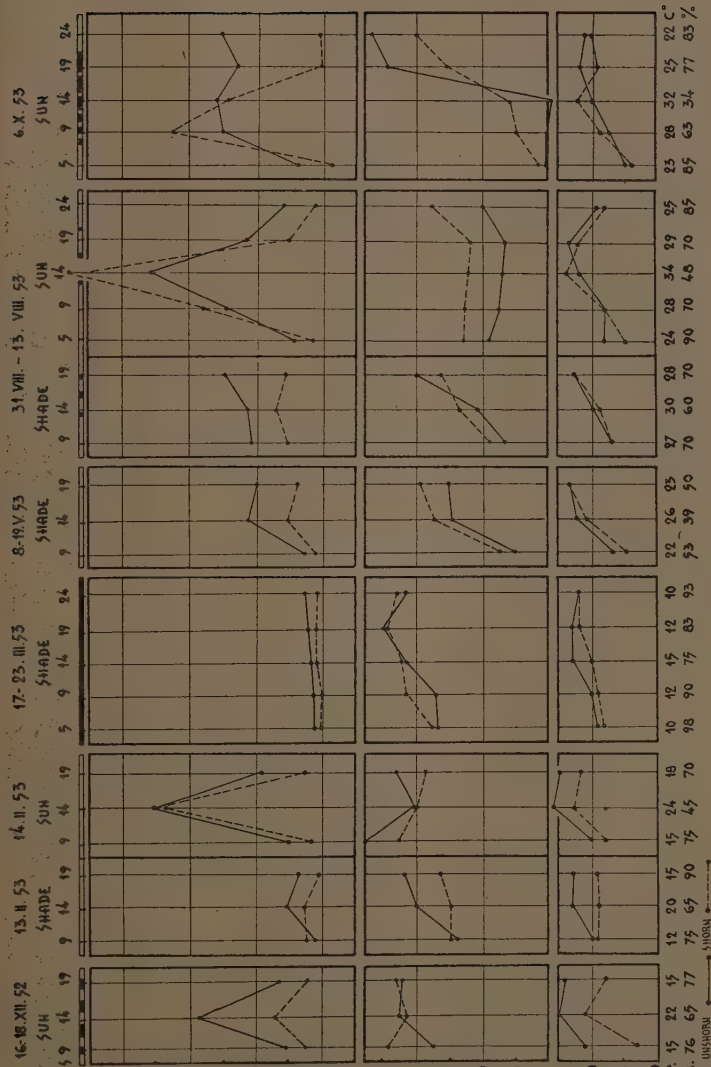

Figure 2

Changes in daily means of body temperature, respiration rate and pulse rate in shorn and unshorn sheep calculated from measurements made at 09.00, 14.00 and 19.00.

relative humidity was high, the reverse was true under dry air conditions.

Experiments were undertaken by us in order to clarify further the role played by the fleece as a factor in the heat exchange between the animal body and its environment.

The experiments were carried out during the period: December 1952—October 1953, records being taken under field conditions at the Giv'at Brenner herd near Rehovot.

The milk sheep of the Awassi breed, which is so far the only breed grown by Israel farmers, were used. These sheep belong to the fat-tail group, and they possess a rough wool which contains a high percentage of hair. The milking season lasts from December to July, milk yields averaging 20 kg per ewe annually.

The experimental material consisted of 10 sheep of which 5 were shorn. Shearing took place every month. In May readings were taken on 10 more sheep, thus the data for May were taken of 5 sheep shorn throughout, of another 5 shorn in the middle of the observation period, and of 10 unshorn sheep.

Climatic data are given in Table I.

TABLE I

Mean air temperature and relative humidities during experimental periods

Period	Hours of the day									
	05.00 *		09.00		14.00		19.00		24.00 *	
	air tmp.	rel. hm.	air tmp.	rel. hm.	air tmp.	rel. hm.	air tmp.	rel. hm.	air tmp.	rel. hm.
16—18.12.52 outside	13.5	78	16.0	75	21.5	64	17.0	75	15.0	75
13.2.53 in the shed	11.0	90	13.5	75	19.5	65	16.0	90	12.5	95
14.2.53 outside	—	—	15.5	75	23.5	45	18.0	80	—	—
17—23.3 in the shed	10.3	98	12.5	89	14.5	75	12.0	83	10.3	93
8—19.5. in the shed	18.5	73	21.5	53	26.0	39	23.0	50	18.5	79
31.7—13.8. in the shed	24.0	90	27.0	70	30.5	60	28.0	70	25.0	85
31.7—13.8 outside	—	—	28.0	72	34.5	48	29.0	71	—	—
6.10 outside	22.5	86	28.0	55	32.5	34	25.0	77	22.0	83

Readings on the sheep were taken daily at 0900, 1400 and 1900, and occasionally also at 0500 and midnight.

Body temperature was taken per rectum, pulse rate with a stethoscope, and respiration rate by flank movements.

* at 05.00 and 24.00 measurements were made only in the shed

On August 16th and 17th readings were taken at noon on sheep which had just returned from pasture, to appraise the changes in body temperature and cardio-respiratory activities during rest, first in the sun and then in the shade, following physical activity. Results are given in Figures 1, 2 and 3.

Rectal temperature

With the exception of the summer, when animals were fully exposed to the sun, the rectal temperatures of shorn sheep were lower than those of the unshorn. The most striking differences between groups were observed in winter. The daily temperature curve (Figure 1) of the groups for the period August—October is of particular interest. While the temperature increased gradually from morning to evening in the unshorn sheep, in the clipped animals a steep rise reaching a maximum at noon to fall off towards evening was observed. Figure 3 also brings out the faster cooling of shorn sheep when kept in the shade. The differences in mean daily body temperature between the groups, however, were small and there were no differences in mean body temperature of animals between winter and summer whether shorn or unshorn (Figure 2).

Respiration rate

During all periods, the most striking differences induced by shearing were those relating to respiration rate. While in the shade, during summer or winter, day or night, the respiration rate was always slower in the clipped sheep; in the sun in summer it was considerably faster. Most striking was the proportionate rapid drop in the respiration rate of the shorn animals during the evening and at night. This is dramatically illustrated by the curve showing the respiration rate of sheep during their rest time following their return from the pasture (Figure 3).

Pulse rate

The pulse rate was faster and less stable during winter both in the shorn and unshorn sheep. This might be explained by the fact that winter is the main milking season, indicating a higher metabolic level. During the hot summer months the pulse of the shorn animals was slightly faster than that of the unshorn. Further investigations regarding this pattern are needed before any conclusions can be drawn.

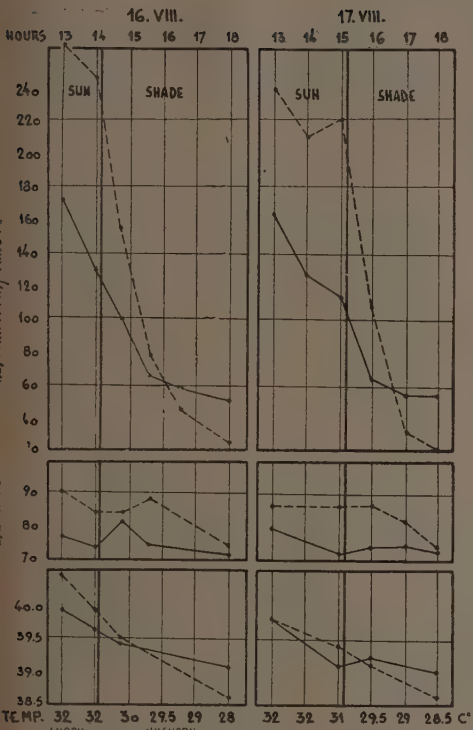

Figure 3
Changes in body temperature, respiration rate and pulse rate in sheep during rest after returning from pasture

The data presented herein show that shorn sheep enjoy a much greater relief during the cool hours and this should be taken into consideration when evaluating the comparative heat tolerance of the sheep. It is further suggested that in various heat-tolerance tests like the Iberia test[7], where the rectal temperature during daylight hours only is taken into account, it might be worthwhile adding also readings taken at night. It seems probable that in other stock also there might be found types which are capable of taking greater advantages than others of the night relief in hot regions.

Our data, however, clearly demonstrate that whereas the fur slows up heat elimination from the body, it gives the animal valuable protection when it is exposed to direct solar radiation.

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The Parallel and Submerged Ridges along the Middle Coast of Israel

The existence of parallel ridges in Israel's coastal plain has been noted before, though only in a general way[1,2,3,4].

It seems worthwhile to draw attention to two further specific properties of these ridges, namely that they are continuous and are accompanied by submerged ridges offshore.

When delineated by means of contour lines and spot heights, the ridges in the coastal plain will be found to form several lines which can be traced continuously from the Tel-Aviv area up to the Carmel tip. These lines are notably parallel with each other. The few short branches and fragmentary ridges lying between these major morphological lines do not affect the general validity of these statements. The accurate description of these ridge-lines is given below by means of grid map references.

The azimuths of these ridge-lines range from about 6° in the northernmost portion to about 16° in the south, thus changing by about $1^1/_2$° per 10 km. The present shoreline is practically parallel with the ridge-lines.

The eastern line starts from Salama, contains the Ramat Hasharon ridge, and its straight continuation joins the Carmel cliffs.

The more seaward line contains in the South the Jalil—Kfar Shmaryahu ridge, and its northward continuation ends in the Kfar Lam — 'Atlit ridge.

The coastal ridges and cliffs form a further line, from the Arab Cemetery ridge in Tel-Aviv, including the El Haram and Natanya ridges. This line submerges north of Giv'at Olga, reappears at Caesarea, submerging and re-emerging at Tantura and at 'Atlit harbour. It is clearly continued by the narrow and elongated shallows off Tira and off the Carmel tip, at a distance of about 1400 metres from the shore.

There is fair evidence for a yet more western ridge which is however completely submerged at a depth of about 30 metres and more. According to Rosenau's *Fishermen's Chart*[5] there is a

fairly broad ($^1/_2$ — 3 km) rocky outcrop at the sea bottom running more or less parallel with the shore, extending from Tel-Aviv up to Tira at a distance of 3 — 5 km from the coast.

The above mentioned chart also shows three peaks, i.e. shallows, on this rocky ridge, which lie on a line parallel with the above mentioned ridges: one of these shallows lies off Shefayim, one off the north of Caesarea and several off the north of 'Atlit.

Two cross sections taken perpendicular to the coast at a distance of 60 km from each other are shown in Figure 1. They exemplify the quite outstanding similarity of the ridge distances, provided the above system of parallel lines is accepted.

The fact that in the northern cross section the two submerged (western) ridges are deeper in the sea than the corresponding ridges of the southern section might plausibly be explained by a relative movement in which the northern portion of the coastal plain is slowly sinking.

The possibility that these morphological lines were formed from spit-like sand bars should be pursued.

H. L. STRI EM

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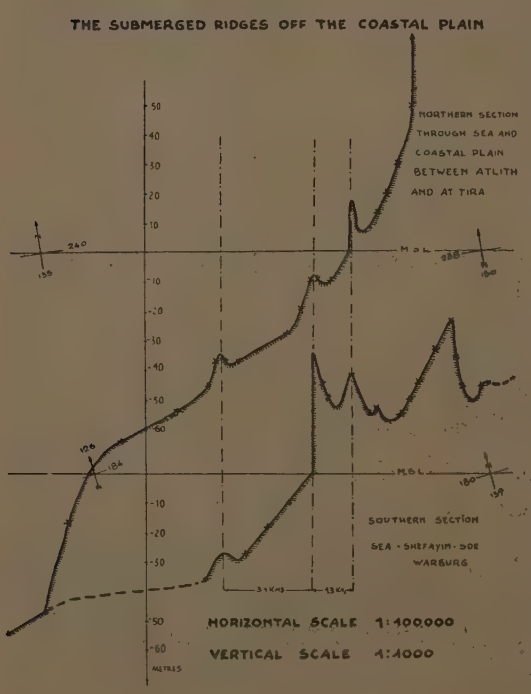
Figure 1



DESCRIPTION OF THE RIDGE LINES

The easternmost line

Salama (1318 1619) — Ramat Gan (1327 1644) — 1341 1689 — along the Ramat Hasharon ridge (1347 1710 — 1354 1723 — 1360 1742 — 1367 1771) — Bnei Zion (1374 1809) — 1387 1844 — contains the Even Yehuda ridge 1397 1875 — 1402 1900 — 1404 1935 — 1412 1966 — Kfar Haroe (1421 1999) — along the Hadera ridge 1425 2015 — 1430 2055 — 1435 2077 — 1442 2122 — Sht. Yaaqov at Binyamina (1446 2142) and ending into the Carmel cliffs through 1448 2162.

The more westerly line

Sumeil (1299 1661) — 1305 1685 — 1311 1704 — along the Jalil—Kfar Shmaryahu—Rishpon ridge (1319 1729 — 1328 1739 — 1332 1771 — 1337 1790) — 1345 1816 — Yaqum (1349 1835) — Udim (1357 1861) — 1364 1890 — along Ramat Tiomkin—Avihail ridge (1369 1914 — 1381 1951) — 1388 1995 — 1393 2016 — 1397 2046 — Heftzi Bah (1405 2073) — 1414 2110 — 1417 2139 — 1425 2178 — along the long and narrow Kafr-Lam ridge (1430 2201 — 1437 2244 — 1440 2269 — 1444 2295) and the 'Atlit ridge (1446 2313 — 1452 2344) — Tell el 'Aqra (1455 2375) — 1460 2412 along the railway line.

The western line

Tel Aviv Arab Cemetery (1285 1665) — 1301 1709 — El Haram ridge (1318 1770—1327 1797) — 1332 1818 — 1342 1852 — 1353 1893 — along Natanya ridge (1357 1911 — 1363 1938) — Havatselet Hasharon (1369 1964) — Minet Abu Zabura (1377 2012) — edging along the sea to Giv'at Olga (1388 2053) — submerging until Caesarea (1400 2114) — along the rocky sea benches to Tall el Malat (1410 2161) — there submerging and reappearing at the islet El Haman (1412 2180) and at Tantura (1426 2248), edging along the rocks to 1430 2276, submerging again until 1434 2316, disappearing under the sea finally at 1436 2337, south of 'Atlit harbour. The line is clearly continued by the elongated shoals at 1443 2387, at 1447 2405 and off the Carmel Cape at 1452 2490.

Note on the Endocrine Tissue in the Pancreas of the Chick

In connection with studies on the endocrine function of the pancreas in the chick embryo and in the newly hatched chick, a survey was made of literature dealing with localization of islets of Langerhans in the pancreas of this animal. Precise information on the distribution of islet tissue in the chick was considered essentially prerequisite to experimental studies because of certain characteristic structural and functional features of the chick pancreas described below. However, the surprising scarcity and incompleteness of basic data in the pertinent literature encountered (for recent reviews see Hamilton[1] and Sturkie[2]) suggested the necessity for a revision of this question. The following is a brief report of the findings.

A series of embryos 10 to 20 days old and of newly hatched chicks 1 to 20 days of age were examined anatomically and histologically. In all of these the pancreas was seen to consist of two distinct, anatomically and topographically separated parts: a relatively large *ventral lobe* built of a pair of partly fused, tongue shaped processes, lying in the loop of the duodenum, and a much smaller *dorsal lobe*. The lobes converge on a site at the beginning of the duodenum where the pancreatic and cystic ducts open into the alimentary tract. Further examination disclosed the presence of an additional very slender and quite inconspicuous process, extending from the dorsal lobe towards the spleen and tapering off rapidly to a hardly distinguishable strand of tissue. We have termed this structure the *dorsal process*. In the immediate vicinity of the spleen, the dorsal process expands abruptly to form a relatively large, knob-like thickening attached by connective tissue to the splenic capsule. In late embryos and in young chicks, delicate secondary extensions of pancreatic tissue spread out from here into the splenic mesentery and the connective tissue surrounding the spleen. Due to the seemingly isolated position of these extensions and of the terminal knob from the main body of the pancreas, their actual relationship is not immediately obvious and their existence or exact identity have previously been overlooked[3]. The practical implications of this may be quite significant. For instance, it appears from the present observations that total pancreatectomy in the chick is not feasible unless the inconspicuous dorsal process and its extensions are removed, in addition to the main lobes of the pancreas. This can be achieved only if considerable parts of the splenic mesentery and of the perisplenic connective tissue are excised. Consequently one might cautiously ask whether the frequently mentioned lack of a typical hyperglycemic response to pancreatectomy in the fowl might not, at least in part, have been due to the incomplete removal of the gland. This question gains further validity in view of the histological findings outlined below.

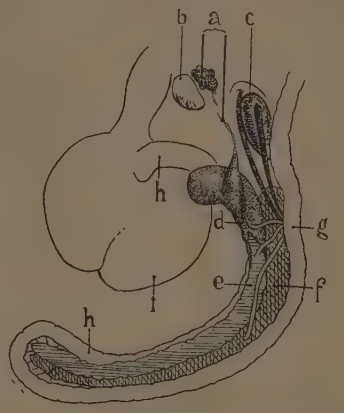


Figure 1
Localization of the pancreatic lobes in a newly hatched chick; dorsal-lateral aspect. a — dorsal process with terminal thickening, b — spleen, c — gall bladder with hepatic and cystic ducts, d — dorsal lobe of the pancreas, e — left ventral lobe, f—right ventral lobe, g—site of entrance of gall ducts and pancreatic ducts into the duodenum, h—duodenum, g—gizzard.

Endocrine tissue in the form of islets of Langerhans is present throughout the whole mass of the pancreas, but the number and density of the islets vary typically. Contrary to previous reports[4,5], typical islet tissue is present in the ventral pancreatic lobe in chicks and in chick embroys from the 13th day of incubation on. The islets in this lobe are usually quite small and not numerous; their density increases considerably in the proximal direction of the lobe. It has been claimed that the origin of islet tissue in the early embryos of higher vertebrates is exclusively in the dorsal lobe of the pancreas[5,6]; their presence in the ventral lobe of the chick pancreas either contradicts the generality of this view or may, perhaps, be due to one of the following reasons: partial fusion between the dorsal and the ventral lobes in the early embryo; ingrowth and migration of presumptive islet tissue from the dorsal into the ventral lobe; independent emergence and development of islet tissue at numerous sites in both lobes. These possibilities are now under experimental investigation.

The histological findings in the dorsal lobe are of particular interest. In the embryo, typically looking islet cells first appear in isolated foci in the dorsal process around the 10th day of development. In the following few days their density and size increase to a most remarkable degree: in the late embryo and in the chick nearly all of the dorsal process and its extensions consist of endocrine tissue. This is especially striking in the terminal knob, which consists almost exclusively of islet cells; there are also thin strands of undifferentiated ductular tissue of the type which, according to Bensley[7], might serve as a potential reservoir of islet cells. There are only very few scattered exocrine acini in this part of the pancreas so that the region of the dorsal process represents, quantitatively, the main concentration of endocrine tissue in the chick. Considering its structure and segregated situation, this part of the gland should be viewed as an "endocrine pancreas" or an "insular body" of a type similar to those found in certain fishes[8] and reptiles, particularly in snakes[9,10].

The types of cells in the islet tissue of the chick are not readily comparable with those in the mammalian pancreas. Staining with Mallory-azan does not enable a satisfactory distinction to be made between α–and β–cells, as it is very difficult to identify critically cells that stain selectively with orange G. Such distinction is possible, however, in sections stained with Gomori's hematoxylin-phloxin. In such it was found that, in contrast with mammalian material, chick islet tissue shows a large preponderance of phloxinophile (α–type?) over basophile cells. It was recently reported that α–cells in the canine pancreas can be selectively destroyed by cobaltous chloride injected into the intact animal[11]. We have found no comparable response in the chick pancreas even with nearly lethal doses, so that this approach does not help in identifying the nature of the phloxinophile cells in this animal.

Concerning the identity of β–cells in the chick, Scott and coll.[12] found that alloxan, which damages selectively β–cells in most mammals, has no such effect in the chick. Since then, however, data have become available[13] in the light of which this negative result might lose its decisiveness. Attempts are now in progress to reinvestigate this problem in relation to identity and function of cells in the endocrine tissue of the chick pancreas.

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Aphis punicae Pass. (Aphidoidea, Homop.) in Israel

In Israel this aphid infests pomegranate, *Duranta plumieri* and *Plumbago capensis*. On the pomegranate a parthenogenetic cycle is pursued during spring, summer and early autumn. The aphids are found on the upper sides of fully-grown leaves, where they spread along the midrib and around the margins. When younger leaves are attacked, they can be found on both sides of the leaves. In December-January sexuales appear on the few leaves which still remain on the tree. The oviparous females lay their eggs in bud axils. In 1950 and 1951 the eggs hatched in the Coastal Plain during March[1]. On *Duranta* this aphid reproduces all the year round parthenogenetically. On this plant both sides of the leaf become infested. On *Plumbago capensis* the aphids were found only in April.

TABLE I

Fluctuations in the population of Aphis punicae *on pomegranate at Miqve-Israel*

Month	*No. of infested leaves in* 50,000				*No. of infested branches in* 10,000	*No. of infested trees in* 20
	*	**	***	*total*		
1949						
November	12	50	83	145	53	11
1950						
February	0	0	0	0	0	eggs only
March	0	3	2	5	2	1
April	60	40	0	100	68	16
May	21	494	718	1233	390	20
June	1	0	0	1	1	1
July	1	0	0	1	1	1
August	17	0	0	17	17	6
September	12	43	51	106	34	7
October	5	32	0	37	14	5
November	27	31	12	70	37	7
December	8	0	0	8	8	5
1951						
January	3	0	0	3	3	3
February	0	0	0	0	0	eggs only
March	0	4	3	7	2	1
April	8	143	318	469	156	20

Counts were carried out on twenty pomegranate trees in an irrigated orchard at Miqve-Israel, from November 1949 to April 1951. No sprays were applied to the trees during that period. Five leaves were examined on 50 twigs taken at random round the tree. The affected leaves were classified as follows, according to the number of aphids found on them: *(1—5), **(6—10), ***(over 10). The infestation was estimated by means of the following data: a) the number of affected leaves in 5000, b) the number of affected twigs in 1000, and c) the number of affected trees in 20.

There are two annual peaks in the size of the population, the major one in spring and another in autumn. During the summer the aphids are usually not abundant, although they can be quite numerous sometimes. The irrigated pomegranates are more heavily infested than the unirrigated ones.

On *Duranta* the maximum infestation occurs in spring and a summer depression is followed by a slight rise in autumn. The extent of infestation during the winter varies under the influence of climate, i.e. in normal winters the population is low, and in warm ones the aphids may be quite abundant.

The aphids injure pomegranates by sucking the sap of the leaves and by being responsible for the growth of sooty mold fungus which develops on their "honey-dew". The injury sustained by *Duranta* shrubs in some sections of this country and during certain years may reach important proportions. When infestation is heavy, the damage takes the form of leaf drop.

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Sorbitol Fermentation of Escherichiae Associated with Infantile Gastroenteritis

In 1951, Kaufmann[1] reported that *Escherichia coli*, sero type 111 : B4 : 2, 111-B4 : and 111 : B4 : 12 ferment sorbitol within 1 day or sometimes after 3 to 5 days, while sero type 55 : B5 : 6 yields negative or irregular reactions. Rappaport, and Henig[2,3] on the other hand, claimed that all freshly isolated serotypes 0 111 and 0 55 belong to the sorbitol-nonfermenting type, and that only after subcultures on laboratory media "some strains" develop the ability to ferment sorbitol. These authors proposed, therefore, to replace the McConkey medium by sorbitol plates and Kligler's iron agar by iron-sorbitol agar for the laboratory diagnosis of pathogenic *coli* strains.

In order to clear up these conflicting results, we examined the biochemical reaction of 111 *coli* strains, isolated from the same number of cases of infantile gastroenteritis on the medium described by Rappaport and Henig[3]. We used this medium for isolation of pathogenic *coli* simultaneously with McConkey plates without confirming the results of Rappaport and Henig, and in addition we kept the isolated cultures in agar stabs and re-examined them after 12 months periods without finding any change of reaction. This examination comprised strains isolated in our laboratory since 1951.

The results were as follows:

The table shows that prior to 1953 sorbitol fermenters were relatively rare. But since 1953 their percentage increased. Serotypes 0 26, 0 86, and 0 114 were almost exclusively sorbitol fermenters, while from serotype 0 126 hitherto only sorbitol-non-fermenters were isolated.

The findings of Rappaport and Henig may be explained by a temporary prevalence of sorbitol-non-fermenters in the particular area from which they received their specimens prior to 1952.

Szenberg[4], working in the Tel Aviv area, also reported that almost 100% of the pathogenic *coli* strains were sorbitol-non-fermenters.

The results reported above show that the replacement of the McConkey medium by the Rappaport-Henig medium is not justified, since by its employment in routine work, sorbitol fermenting pathogenic *coli* will elapse the diagnosis.

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Received January 10, 1955.

* This work constitutes part of the Ph. D. thesis to be submitted to the Senate of the Hebrew University of Jerusalem.

Sero type	Year of Isolation							
	Prior to 1953		1953		1954		All strains	
	Total	Sorbitol Positive	Total	Sorbitol Positive	Total	Sorbitol Positive	Total	Sorbitol Positive
O 111	23	6 (26%)	17	11 (64.6%)	27	12 (44.4%)	67	29 (43%)
O 55	8	2 (25%)	4	4 (25%)	8	2 (25%)	20	5 (25%)
O 26	—	—	4	1 (100%)	7	7 (100%)	11	11 (100%)
O 86	—	—	—	—	5	4 (80%)	5	4 (80%)
O 114	—	—	—	—	5	4 (80%)	5	4 (80%)
O 126	—	—	—	—	3	—	3	—
Total	31	8 (25.8%)	25	16 (64%)	55	29 (52.8%)	111	53 (47.8%)

Colorimetric Determination of the Perchlorate Ion in Organic Perchlorates

The analysis of organic perchlorates cannot usually be carried out by combustion, as violent explosions may occur. A method was therefore sought for the determination of the *perchlorate* moiety of these molecules. The colorimetric procedure described here is accurate enough to permit the determination of the molecular weight of the perchlorates.

The perchlorate of the intensely coloured complex cupric tetrapyridine ion, which has been used for the identification of perchlorates by Weinland and Effinger[1], and by Shead and Bailey[2], is somewhat too soluble in water to allow its quantitative gravimetric determination. However, the decrease in colour intensity due to the precipitation of the perchlorate can be used, under certain well-defined conditions, for a quantitative determination of the perchlorate ion.

The following procedure was adopted: an aqueous standard solution containing 4.883 g of cupric nitrate trihydrate and 100 ml of pyridine per litre was prepared. Quantities of potassium perchlorate varying from 0.3 mg to 4.0 mg were added each to 5 ml of the standard solution. These solutions were saturated with sodium chloride which reduces the solubility of the cupric tetrapyridine perchlorate and thus increases the sensitivity of the method. Under these conditions, the cupric tetrapyridine perchlorate appears as a blue crystalline scum floating on the surface of the solutions. After a few hours, the solutions were filtered, and their optical density was measured in a Klett-Summerson colorimeter, with filter No. 66 (transmission range approximately 6400—7000 A). A calibration curve was obtained by plotting the measured optical densities against the quantities of perchlorate ion present in the solutions.

The unknown percentage of perchlorate ion present in organic perchlorates is determined by adding a weighed quantity of the sample to 5 ml of the standard solution, saturating the solution with sodium chloride and proceeding further as above. The perchlorate content of the solution is read from the calibration curve. In the case of pure organic perchlorates, their molecular weight can be calculated directly.

Table I shows the results obtained with a number of substances.

This investigation was carried out under the auspices of the Scientific Department, Israeli Ministry of Defence, and is published with its permission.

TABLE I

Substance	Percent perchlorate ion		Molecular weight	
	Found	Theoretical	Found	Theoretical
Benzoylcholine perchlorate	32.2; 32.4; 31.9; 32.4; 32.3	32.4	308; 307; 312; 307; 308	307
Brucine perchlorate	19.7	20.1	502; 490	495
Quinaldine perchlorate	42.2; 41.5; 42.0	40.4	236; 240; 237	243.7
Trimethyl-butyl-ammonium perchlorate	45.8; 46.6	46.2	217; 214	215.5
Trimethyl-heptyl-ammonium perchlorate	39.3; 38.1; 38.6	38.8	254; 262; 258	257.5
Trimethyl-octyl-ammonium perchlorate	36.1; 37.4; 37.3	36.6	276; 266; 267	271.5
Trimethyl-dodecyl-ammonium perchlorate	30.9; 30.6	30.4	322; 325	328

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Sunday Morning Session

I. POLYMER SCIENCE AND SURFACE CHEMISTRY

CHAIRMAN E. D. BERGMANN

Interaction of Polymeric Acids with Polymeric Bases, P. SPITNIK, A. NEVO, A. KATCHALSKY*, *The Weizmann Institute of Science, Rehovot.* The interaction of acidic with basic biocolloids was discovered over half a century ago by Kossel[1] and has been ever since a central theme in the investigation of biochemical interactions. The chromosome, the muscle, the fibres of the connection tissue, are typical structures due to interactions of biocolloids of opposite charge. The reactions in the dynamics of the cell of antigen-antibody and of enzyme with macromolecular substrate are examples of this type of reaction. Fuoss and Sadek[2] showed that similar reactions may be carried out with synthetic polyelectrolytes and, since the mutual interactions of synthetic polyelectrolytes constitute much the simpler case, they are more suitable for the investigation of physico-chemical behaviour, with the additional advantage that this may be carried out with well defined material. This paper deals with an investigation of the interaction of polymethacrylic acid with polylysine by turbidimetric and potentiometric methods.

Mixing of electrically charged polymers of opposite sign usually results in either partial or complete precipitation in the form of coacervates or as floccules. Maximum precipitation is obtained when the total number of negative charges carried by the acidic polymer is equal to the total number of positive charges carried by the basic polymer. In the case of weak polyacids and polybases the charge density is a function of pH and hence the ratio of the components needed to achieve maximum precipitation varies markedly with the pH of the medium. This is shown in Figure 1, in which the ratio of the concentration of acidic to basic polymer in the solution (in base molecules) at maximum precipitation (represented by maximum turbidity) at different pH is plotted (versus the pH).

It will be observed that at low pH, at which the charge density of the polyacid is low, a large relative concentration of polyacid is needed, and the reverse is true for the alkaline range. Between pH 4—6, where both components are fully ionized, the base molar ratio is approximately unity.

There is a striking similarity between the behaviour of the reaction mixture at the point of maximum precipitation and the behaviour of synthetic polyampholytes at the isoelectric point. The similarity is obvious also from potentiometric titration of polymethacrylic acid with polylysine.

It will be observed that at the point of electro-

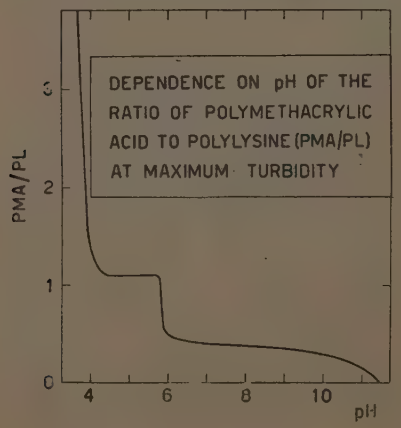

Figure 1

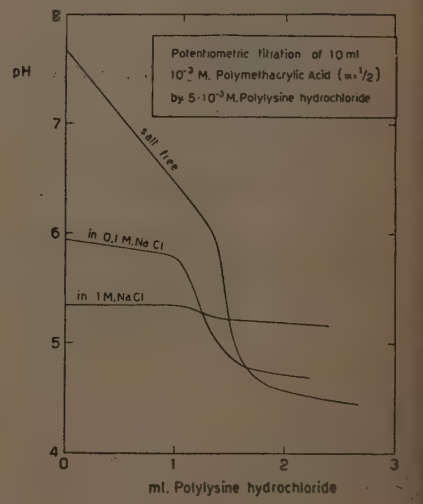

Figure 2

chemical equivalence of polybase and polyacid a sharp decrease in pH occurs. A similar decrease was found by Katchalsky and Miller[3] in copolymers of vinylpyridine and methacrylic acid and their interpretation of the phenomenon (termed the "isoelectric jump") seems appropriate in this case also.

It is worth noting that the isoelectric jump gradually diminishes with increasing ionic strength (in 0.1 M and 1 M NaCl of Figure 2). The screening effect of higher salt concentrations weakens the complex-forming forces and obscures the polyampholyte character. This salt effect is held responsible for dissolving of precipitated complexes and is of great value in the extraction and fractionation of complexes derived from biological systems.

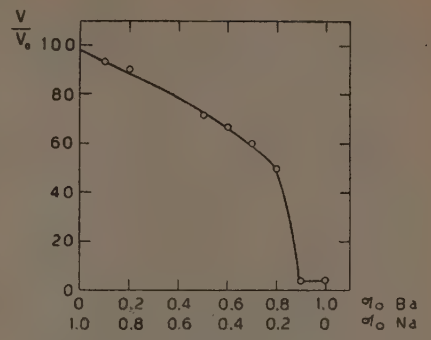

Figure 1

Dependence of swelling of a fully ionized polymethacrylic acid gel on the ratio of barium to sodium ions

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The Mechano-Chemistry of Ion Exchange, A. Katchalsky, M. Zwick*, *The Weizmann Institute of Science, Rehovot.* Mechano-chemistry is the study of mechanisms which, by working in cycles, are capable of transforming chemical energy directly into mechanical work.

The examples studied hitherto were highly swelling polyelectrolyte gels capable of large dimensional changes through variation of their degree of ionisation[1,2,3,4].

In this work we investigated the mechano-chemical possibilities of polyelectrolyte gels through ion exchange of monovalent ions by bivalent ions at constant degree of ionization. As such it forms part of a more general investigation into mechano-chemical systems based on the reversible variation of the strain—stress relation of a polymeric substance by chemical reaction.

The effect of substituting barium for sodium as a positive counter ion in a fully ionized gel of polymethacrylic acid is shown in Figure 1. The curve shows the volume decrease accompanying the increase of barium content in the gel. At a barium content of about 85% there is a very marked drop in the swelling volume, which makes this region of particular interest for the performance of mechanical work due to small changes in the chemical potential of the exchanging ions.

Figure 2 shows the force-elongation relations of krillium fibres with either sodium or barium as their counter ions. Here elongation corresponds to the volume increase of the polymethacrylic acid gel. It will be observed that the fibres are invariably longer in the pure sodium than in the pure barium bath, so that a transfer from a sodium to a barium bath is accompanied by a contraction. A possible mechano-chemical cycle which transforms the chemical energy of the reaction

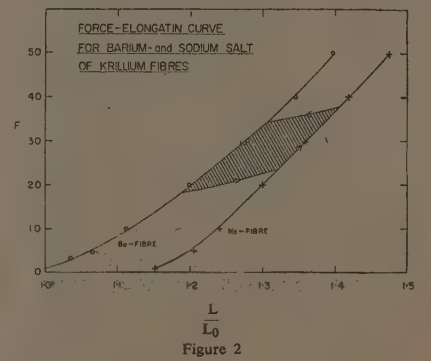

Figure 2

$$NaR + Ba^{++}/2 \longrightarrow BaR/2 + Na^{+}$$

into mechanical work is given in the shaded part of the figure.

The reversal of such a cycle constitutes a possible mechanism for the transformation of work input into ion exchange and may be termed an "ion exchange pump".

From the biological point of view one can clearly appreciate the potentialities of both an

"ion exchange pump" and performance of mechanical work due to ion exchange in context with metabolic functions.

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Absorption of Polymeric Surface Active Substances in Mercury Water Interfaces, I.R. MILLER*, *The Weizmann Institute of Science, Rehovot*, and D. C. GRAHAME, *Amherst College, Amherst, Mass.* Differential capacities of the electric double layer on the boundary of mercury and aqueous solutions of .09 N $NaClO_4$ and .01 N $HClO_4$ containing various concentrations of polymethacrylic acid (P.M.A.) as well as solutions of 0.06 N NaF + 0.04 N NaOH containing polylysine (P.L.) were measured. The measurements were carried out at different temperatures and frequencies. The principal desorption peaks were obtained — one at a potential in a range between 70 V for 0°C and −.75 V for 80°C, and the second at a potential of about +.45 V relative to the hydrogen electrode at pH 2. The peaks are dependent on the frequency of the alternating current imposed on the bridge. At high temperatures and low frequencies the capacity at the peak reaches an equilibrium value. At low temperatures and high frequencies another frequency independent value is obtained. In this case there is complete suppression of the desorption processes, and the true capacities of covered and uncovered parts of the surface in parallel are measured.

The temperature dependence of the frequency effect is considerably stronger in P.M.A. than in monomeric substances. The frequency effect is a function of the diffusion of the segments of an absorbed polymeric molecule from and into the surface. The diffusing segments have to pass an energy barrier of about 5.3 kilo calories per mole of segments, which is the order of magnitude of a hydrogen bond.

The absorption of P.M.A., unlike that of isobutyric acid, its monomeric analogue, already takes place at very low-bulk concentrations, and the position of the desorption peak does not depend on the concentration. In the case of P.L. which is highly surface active, no desorption peaks at usual polarization potentials could be observed.

* This work was carried out in the Chemistry Department, Amherst College, and was supported by a U.S. Office of Naval Research grant, which is gratefully acknowledged.

From the behaviour of P.M.A., P.L. and of isobutyric acid, the following conclusions on the character of polymeric absorption could be drawn. The absorption energy of a polymeric molecule is built up additively from the absorption energies of all the absorbed segments which belong to the same polymeric molecule. The rest of the segments of the absorbed polymer are suspended from the surface into the solution, creating in the neighbourhood of the surface a concentrated layer which we call the *surface phase*. The packing of the polymer-segment in the absorption layer is never entirely close, and it depends on the extent of coiling of the polymeric molecule.

The Theory of Potentiometric Titration of Copolymers of Dibasic Acids, J. MAZUR, *The Weizmann Institute of Science, Rehovot*. The total charge of the copolymers of dibasic acids distributes itself into two componental groups: the monoionized monomers and the bi-ionized monomers. The equations which describe the conditions under which the equilibria between the hydrogen ions and the charged monomers hold place were obtained with the help of statistical mechanical methods. We treated the whole system, which consists, besides the polymeric molecules with fixed charges, of counter ions in the solution and of an added electrolyte, as a grand canonical ensemble with two variable components. For the variable components we choose the total charge υ and the number of bi-ionized acidic monomers υ_2. One of the two equations describes the potentiometric behaviour of the solution which contains the copolymer of the dibasic acid. It determines pH as a function of the basic dissociation constant pK^0 of the acidic group, of the electrostatic field energy of the molecule, of the total charge υ, and of the number of the bi-ionized acidic monomers υ_2. The second equation determines υ_2 as a function of υ. For the given total charge υ (which can be experimentally determined from the degree of neutralization of the copolymer), the number of bi-ionized acidic monomers is found to depend 1), upon the repulsive forces which act between the charged groups within the acidic monomers, and 2), upon the total electrostatic field produced by the whole molecule. The total electrostatic field can be calculated from the statistics of the randomly coiled macromolecule. The repulsive forces which act between the charged groups in the monomer depend not only upon the distances between the charges, but also upon the structure of the monomer which carries the

acidic charges and of the monomer to which it is attached in the polymeric chain. Therefore, different copolymers of the same acid with different neutral molecules show different potentiometric behaviours.

We calculated υ_2 as a function of υ for copolymers of maleic acid with styrene, with allyl acetate, and with vinyl ethyl ether. These calculations were based upon the structural parameters of these copolymers. Once one obtains υ_2 as function of υ, the potentiometric behaviour of the copolymer can be calculated from the first of the two equilibrium equations. The calculated and the experimental potentiometric curves of these three copolymers were found to be in good agreement. These calculations show that the electrochemical behaviour of the copolymers of dibasic acids with neutral molecules depends not only upon the intrinsic acidic dissociation constant of the ionizable group in the copolymer and upon the molecular shape, but also upon the structural parameters of the monomers which carry the acidic groups, and their immediate environment.

The Root-mean-square Length of 1 : 4' Polysaccharides such as Cellulose Derivatives and Alginic Acid, H. J. G. HAYMAN, *The Hebrew University of Jerusalem.* A general expression for the root-mean-square length of 1 : 4' polysaccharide molecules consisting of pyranose rings in the "chair" form was obtained by a modification of Benoit's method[1]. This expression was based on the simplifying assumptions that the rigid pyranose rings are completely symmetrical and that the (partially restricted) rotations about any two non-adjacent C—O bonds are independent of each other. In the special case of free rotation, the expression obtained agrees with that given by Benoit, but his result for the case of restricted rotation was found to be an over-simplification.

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Multilayer Adsorption of Water on Plane Glass Surfaces, U. GARBATSKI, M. FOLMAN*, *Technion — Israel Institute of Technology, Haifa.* The adsorption of water vapour at relative pressures from 0.505 to 0.9976 on plane glass surfaces was measured. The capacities of a condenser formed by two glass plates in equilibrium with water vapour at different pressures gave a direct measurement of the amount of water adsorbed on a defined surface. Using certain assumptions, the thickness of the water layer at 30°C was found to be from 37 A to 620 A in the pressure range described above.

This constitutes one of the very few direct measurements of multilayer adsorption and an additional proof for its existence.

Details of the apparatus measuring changes in capacities to 0.001 μF at 5.3 Mc are given. The assumptions for the calculation of the thicknesses are discussed, and it is shown that values given should be lower limits of layer thickness.

Afternoon Session

L. FARKAS MEMORIAL SYMPOSIUM

II. DESALTING OF BRACKISH WATER

1. Opening, G. STEIN, *The Hebrew University of Jerusalem*, CHAIRMAN.
2. Proposed methods for desalting water and their economic value. I. DOSTROVSKY, *The Weizmann Institute of Science, Rehovot.*
3. Water sweetening by ion exchangers and permselective membranes. A. KATCHALSKY, *The Weizmann Institute of Science, Rehovot.*
4. Vapour Compression Distillation. W. RESNICK, *Technion — Israel Institute of Technology, Haifa.*

Evening. Reception by the Hebrew University and the Jerusalem Branch of the Israel Chemical Association.

Monday Morning Sessions

III. INORGANIC CHEMISTRY

CHAIRMAN, H. HEIMANN

Basic Phenomena of Heterometry and their Explanation. M. BOBTELSKY, *The Hebrew University of Jerusalem.* Heterometry, the quantitative photometric study of chemical reactions in suspensions, enables study of reactions which occur in solution in the solid state and of intermediate as well as final reactions. Heterometric titration curves (optical density curves) are obtained and critical points determined. Particles of identical or varying size and concentrations of 0.1 to 10^{-6} M can be studied.

While a linear relationship between the quantity of material and the light absorption exists in "turbidimetry", it does not exist in heterometry.

Heterometric studies are generally combined with parallel conductometric and with pH-titrations which give essential detailed information on pH conditions necessary for formation and dissolution of precipitates. This information is especially valuable in micro- or macro-heterometric (or gravimetric) analysis, and is of immense importance in the chemistry of complex formation. In most cases, adsorption does not interfere with the measurements, and heterometric titrations can be made with sodium or potassium hydroxide, or with salts such as sodium carbonate or sodium phosphate.

The Mercuric-mercaptobenzthiazole Compounds, M. BOBTELSKY, E. JUNGWEIS, *The Hebrew University of Jerusalem.* The structure and composition of the compounds formed between mercury and mercaptobenzthiazole were studied. Many investigators state that mercaptates are salts which do not form complexes. Since, however, $Hg(MBT)_2$ is insoluble in water and very easily soluble in alcohol, it seemed that the compound could not be a regular sulfide. Mercury was also found to form easily a soluble anion complex of the composition $[Hg(MBT)_2]^{2-}$.

Both 1—2 mg mercuric mercury and MBT in 20 ml solution could be determined in microquantities by one heterometric titration with an error of 0—3%. Since the determinations could be carried out in the presence of ethylenediaminetetraacetate in an acidic or neutral solution and in the presence of large excesses of citrate or tartrate in alkaline solution, the method is especially suitable for the determination of mercury in the presence of large excesses of other metals such as bismuth and copper (98%).

Technological Problems in the Production of Chlorine Trifluoride, A. PELLEG, *Scientific Department, Ministry of Defence.* One of the most interesting chemicals in the halogeno-fluoride field is chlorine trifluoride, which is produced in quite large quantities in some countries. The task of producing this chemical on a pilot plant scale in Israel requires a thorough knowledge of all the technological problems of handling extremely reactive raw materials and products.

Hydrogen fluoride is electrolyzed to give fluorine which is purified and allowed to react with the other starting material, chlorine. A series of possible designs and materials for the different unit operations and the role of the packing of the reactor have been studied. The engineering data required for large scale production have been collected, and the most suitable types of measurement and control instruments have been determined. Useful experience has been gained regarding the storage and the properties of the final product.

IV. ANALYTICAL CHEMISTRY

CHAIRMAN, M. BOBTELSKY

A Semi-Micro Determination of Fluorine in Organic Fluoro-Compounds, CH. EGER, A. YARDEN, *Scientific Department, Ministry of Defence.* A semi-micro method for the determination of fluorine in organic fluoro-compounds has been developed. The quantity of the sample needed for the determination is 20—60 mg, depending on the fluorine concentration in the compound.

The organic fluorine is converted to fluoride ion by combustion in a 8 ml semi-micro stainless bomb especially constructed for this purpose and electrically ignited. The combustion is carried out in a mixture of sodium peroxide as oxidant, potassium perchlorate as accelerator, and sucrose as combustion aid. The melt is dissolved in water. However, the relatively high concentration of foreign salts in this solution interferes with the determination of the fluoride ion. Therefore, the solution is percolated through a column of acidic cation exchanger (AMBERLITE—IR 112) and the acidic percolate collected in dilute sodium hydroxide solution. The fluoride is determined in this solution by titration with thorium nitrate, using sodium alizarin-sulfonate as indicator, and keeping the pH at 3.55 with a suitable buffer.

The average error is 0.6%.

The presence of chlorine and bromine or nitro- or amino-groups in the organic fluoro-compounds does not interfere. Chlorine and bromine can be determined simultaneously with the fluorine.

Colorimetric Determination of the Perchlorate Ion, W. BODENHEIMER*, H. WEILER, *Scientific Department, Ministry of Defence.* The perchlorate ion gives a crystalline precipitate with the cupric pyridine cation. The ensuing decrease in the colour intensity of solutions of cupric-tetra-pyridine nitrate can be measured colorimetrically and used for the quantitative determination of the perchlorate ion. Under the conditions of the method the interference of a great number of anions and that of the alkali and earth alkali cations has been eliminated. It is also possible to determine with this method the perchlorate ion in salts with organic bases.

In contrast to other procedures this is a practical direct method for the determination of the perchlorate ion without previous reduction to chloride.

* Present address: Geological Institute, Government of Israel and The Hebrew University of Jerusalem.

A Colorimetric Method for the Rapid Determination of Silica in Boiler Waters in Presence of Phosphates, H. LOEWEN, A. C. FRIEDLAND, *The Palestine Electric Corporation, Ltd.* The silica (SiO_2) present in the boiler water can, at high pressure and temperature, be carried over with the steam, settle in various systems and cause serious damage. The determination of silica in this water is therefore of importance.

As the boiler waters contain also phosphates, the usual method with ammonium molybdate cannot be directly applied, the phosphomolybdate being more intensely coloured than the silicomolybdate.

Topsch, Ammer and others already stated that the phosphomolybdate is easily decomposed in the presence of some dibasic organic acids such as oxalic or citric acid.

On this basis a method and optimal conditions for the rapid colorimetric determination of SiO_2 were developed. It was possible to estimate 0.5—30 mg/l SiO_2 in the presence of up to 300 mg/l Na_3PO_4.

V. MOLECULAR STRUCTURE

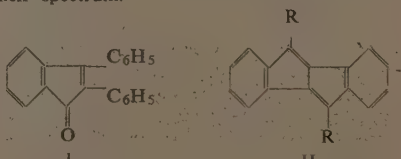
CHAIRMAN, D. GINSBURG

New Observations on the Spectra of Some Polycyclic Substances, E. D. BERGMANN, *The Hebrew University of Jerusalem.* The application of the method of "linear combination of atomic orbitals" (LCAO) has led to a number of surprising results, especially in the series of non-alternant aromatic compounds of fulvene type. The present communication deals with some new observations based on such calculations.

(a) Fulvene ketones (e.g., I) are characterized by their deep colour and high polarity. By replacing the phenyl groups in (I) with other aromatic substituents, it was attempted to determine whether it is possible to assign the absorption bands to specific absorbing systems within the molecule. The result was that the molecule absorbs as a whole. Also the infra-red spectra lead to the same conclusion.

(b) According to the theory, also the polycyclic quinones should show increased polarity; this effect expresses itself in the wave length of the infra-red carbonyl absorption. According to measurements carried out by Fuson and Josien at Fisk University, there exists a strict parallelity between the wave-length of the carbonyl vibration and the redox-potential, and also the free valency index of the parent hydrocarbon.

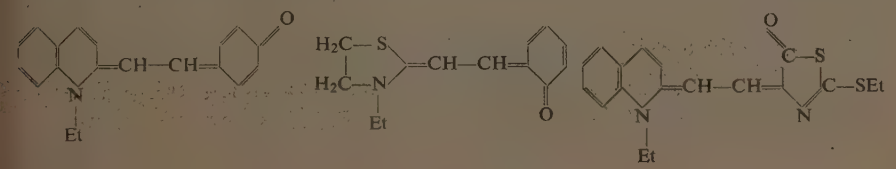
(c) A surprising effect was discovered in hydrocarbon of type II. It was known that in substances of the 9,10-diphenyl-anthracene type the introduction of the phenyl groups does not cause a bathochromic effect. This is explained by the hypothesis that for steric reasons the phenyl groups cannot be coplanar with the anthracene system and that, therefore, no resonance exists between the various rings. On the other hand, calculations show that this effect of non-coplanarity should cause a bathochromic effect in the system II, whilst coplanarity would lead to a certain amount of hypsochromy. This calculation has been confirmed by the preparation of a series of representatives of (II) and determination of their spectrum.



I II

Some Factors Influencing the Colour of Merocyanine Dyes, Y. HIRSHBERG, E. FISCHER, *The Weizmann Institute of Science, Rehovot.* In connection with work on photochromism, we carried out an investigation of the influence of various environmental factors on the colour of some merocyanine dyes.

All the compounds examined are combinations of basic nuclei and carbonyl-containing nuclei, connected by a dimethin bridge. Three representative compounds are given in the following formulae:



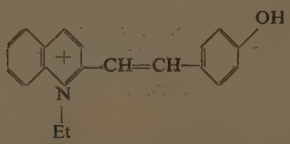
According to the results obtained, the investigated dyes may be divided into two groups: (a) dyes possessing two absorption bands, about 100 m μ apart, in the visible region, and (b) dyes possessing under all conditions only one main visible band, corresponding to the longer wavelength band in group (a). Even equivalent quantities of acid raise the band at shorter wavelength and lower the band at longer wavelength. The extent of this change varies from compound to compound.

These spectral changes resulting from the addition of acid to dyes in group (a) can also be brought about by three other environmental factors — dilution, cooling to about minus 100°C, and replacement of up to 90% of the solvent ethanol by water. All three factors do not affect solutions of dyes of group (b).

The effects of cooling and of addition of water on the ratio between the two absorption bands can be annulled by the addition of roughly equivalent quantities of triethylamine, which acts as a weak base. At room temperature, on the other hand, triethylamine scarcely affects the absorption spectrum.

Another result of cooling or addition of water is a hypsochromic shift of the long wavelength band, observed to various degrees with dyes in both groups.

The following explanation of the above phenomena is advanced: the longer wavelength band is due to the dye proper, while the shorter wavelength band is ascribed to a quaternary cation formed between the dye base and a proton from the solvent ethanol or water; thus the first compound given in the above formulae would form the cation



The equilibrium between the dye and the solvent is analogous to that between the dye and its salts with mineral acid, this equilibrium also being found to depend on the concentration and the temperature. The dye-solvent compound is, of course, much less stable and exists only in the presence of a large excess of solvent, as present in very dilute solutions. Cooling has the combined effect of shifting the equilibrium in favour of the dye-solvent complex and of strongly increasing the dielectric constant of the solutions, thereby causing the hypsochromic shifts described. Part replacement of the ethanol by water results both in the competitive formation of a dye-water compound and, in analogy with the effect of cooling, in an increase of the dielectric constant of the solution, causing a hypsochromic shift of the longer band. The varied behaviour of the merocyanines may in general be attributed to differences in their basicity, dyes of group (b) being so weakly basic that they are unable to form solute-solvent compounds. The difference between the action of triethylamine at room temperature and at low temperatures is probably also due to the higher dielectric constant under the latter conditions.

The Molecular Structure of Hexamethylbenzene from the Ultraviolet Spectrum, O. SCHNEPP, *Technion — Israel Institute of Technology, Haifa.* In a previous report the ultraviolet spectrum of crystalline hexamethylbenzene (H.M.B.) was described. It was shown that the O—O transition of the first absorption system appears in polarized light, polarized perpendicular to the plane of the benzene ring but not in the plane of the ring.

The analogous electronic transition in benzene is forbidden and, therefore, the O—O transition does not appear in this case. In the case of crystalline H.M.B. it remains to be determined which of three possible types of perturbation can produce this transition:

1. Perturbation by the lattice of the crystal,

2. Perturbation caused by non-planarity of the carbon skeleton,

3. Perturbation by the methyl groups.

It has been shown that only 3. can produce the O—O transition which is allowed perpendicular to the plane and forbidden in directions contained in the plane. From this it was possible to reach the conclusion that in the equilibrium position the methyls arrange themselves so as to destroy the reflectional symmetry in the plane of the ring. This conclusion allows the decision that the hindered rotation potential of the methyls about the C—C bond has a periodicity of 6 and that the interaction potential between different methyl groups is not a principal determining factor in the structure of the molecule in its equilibrium position.

Afternoon Session

VI. KINETICS AND REACTION MECHANISMS

CHAIRMAN, I. DOSTROVSKY

The Decomposition of Strongly Alkaline Solutions of Hypobromite, B. PERLMUTTER-HAYMAN, G. STEIN, *The Hebrew University of Jerusalem.* The decomposition of alkali hypobromite solutions with the formation of bromate and bromide has been the object of several investigations[1]. It appears that in strongly alkaline solutions another mode of decomposition becomes predominant which has not yet been investigated. In this reaction the oxidizing capacity decreases, presumably through the formation of molecular oxygen according to the net process

(1) $BrO^- \rightarrow Br^- + 1/2\ O_2$.

Whilst the first mode of decomposition is of second order with regard to hypobromite the reaction shown in (1) was found to be of the first order with regard to hypobromite.

This reaction appears to be influenced by glass surfaces, which inhibit it. An investigation of the pH dependence of the overall reaction yielded an explanation of the minimum in the rate of hypobromite decomposition at pH∼13, reported in the literature[2]. The influence of the variation of (OH^-) on the reaction rate indicates that the hydroxyl ions play an active role in the reaction, possibly through

(2) $BrO^- + OH^- \rightarrow Br^- + HO_2^-$.

This latter point will be investigated by means of isotopic analysis and comparison with hypochlorite.

REFERENCES

1. See ENGEL, P., OPLATKA, A. and PERLMUTTER-HAYMAN, B., 1954, *J. Amer. Chem. Soc.*, 76, 2010, where earlier literature is quoted.
2. CHAPIN, R. M., 1934, *ibid.*, 55, 2211.

Diffusion Controlled Kinetics Equations in Radiation Chemistry of Liquids, A. H. SAMUEL, *Technion—Israel Institute of Technology, Haifa.* Classical kinetics involve time and concentration as the only variables; but when reactions are considered which are rapid compared to the time necessary for establishing homogeneity in the medium, one must consider the variation of concentration with space coordinates. One such case is that of the radiation chemistry of liquids. In water, for instance, ordinary kinetics can only describe a number of initial reactions

By describing the simultaneous diffusion and recombination of H and OH radicals which are formed in spurs, it has been possible to account quantitatively for the observed yields of the initial reactions. This involves the differential equation

$$\partial c/\partial t = D\nabla^2 c - Rc^2$$

which has not been solved exactly. An approximate solution by Jaffe has been used, as well as a second bounding approximation. The solution is contained between these two approximations, which nowhere differ by more than 10%.

The Kinetics of Isotopic Exchange Reactions*, C. A. BUNTON, D. P. CRAIG, E. A. HALEVI*, *University College, London, University of Sidney* and *The Hebrew University of Jerusalem.* Two general cases of isotope exchange are treated theoretically: a) Associative exchange of a labelled atom X* between the molecular species AX_n and BX_m; b) Dissociative exchange of X* between the species AX_n and X.

In order to facilitate the general treatment two basic assumptions were made, both of which can be justified in cases where the exchangeable atoms are not bonded to each other: a) the distribution of molecules with different degrees of labelling within each species is random; b) the rate coefficients governing the attachment and detachment of differently labelled atoms are not affected by the isotopic nature of the rest of the molecule.

An expression is derived for the kinetics of associative exchange that depends on the equilibrium constant of the exchange but not on kinetic factors. The expression derived for dissociative exchange is similar, but depends also on the relative rates of the various steps in the exchange.

When isotopic fractionation is negligible, both expressions reduce to the familiar McKay equation[1]. When fractionation does occur but the concentration of labelled isotope is low, both expressions reduce to the first order kinetic form derived by Harris[2] for the simple case $n=m=1$.

The magnitude of the effect of the various factors on the kinetic form is such that under most working conditions — except for exchanges involving hydrogen isotopes — neither appreciable deviation from first order kinetics, nor differences in kinetic form due to different mechanisms, are to be expected.

REFERENCES

1. MCKAY, N. N., 1938, *Nature*, 142, 997; 1943, *J. Amer. Chem. Soc.* 65, 702.
2. HARRIS, G. M., 1951, *Trans. Faraday Soc.*, 47, 716.

* Based on a paper to be published shortly in the *Transactions of the Faraday Society.*

The Determination of the Polarization of Bonds in Organic Compounds of Nitrogen, Oxygen and the Halogens, Using O^{18}, A. D. YOFFE and D. SAMUEL*, *The Weizmann Institute of Science, Rehovot.* Three series of very reactive compounds of nitrogen, oxygen and the halogens are known: the nitrosyl halides NOX, the nitryl halides NO_2X, and the halogen nitrates NO_3X (where X, the halogen, in some cases is coordinated to an organic base, such as pyridine).

Many of these compounds are very useful reagents in synthetic organic chemistry. In reactions with nucleophilic reagents, such as water, alcohols, amines or carbonions, the nature of the products depends to a large extent on the polarization of the bonds between the halogen atom and the rest of the molecule. Thus nitrosyl bromide forms *nitrites* with alcohols indicating a polarization $\overset{\delta+}{NO}—\overset{\delta-}{Br}$, nitryl bromide reacts as $\overset{\delta-}{NO_2}—\overset{\delta+}{Br}$ forming hypobromites, whilst nitryl fluoride is a *nitrating agent* reacting as $\overset{\delta+}{NO_2}—\overset{\delta-}{F}$. A simple method for determining the direction of the bond polarization in the molecule is to analyse the isotopic oxygen content in the nitrate or nitrite found in the reaction with water enriched in O^{18}. Thus the nitrate formed from nitryl bromide contains one atom labelled with O^{18} per molecule indicating a reaction $\overset{\delta+}{NO_2}—\overset{\delta-}{Br} \xrightarrow{H_2O^{18}} NO_2{}^{16}O^{18-}$, whereas that formed from "bromine nitrate" contains no heavy oxygen: $\overset{\delta-}{NO_3}—\overset{\delta+}{Br}(Pyr)_2 \xrightarrow{H_2O^{18}} NO_3^-$.

Owing to the rapid isotopic exchange between the hypohalous acids and water, this method cannot be used to determine the polarity of the halogen atoms. But by using *tert.* butyl alcohol enriched in O^{18} and analysing the comparatively stable tertiary-butyl hypohalites formed, an indication of the bond polarization in the parent molecule is obtained.

$$\overset{\delta-}{NO_2}—\overset{\delta+}{Br} \xrightarrow{t\text{-}BuO^{18}H} t\text{-}BuO^{18}Br$$

From experiments on various members of these series of compounds it is found that the tendency for the halogen atom to be the positive end of the dipole increases in the order $NO_3X > NO_2X > NOX$, and on varying the halogen within each series in the order $I > Br > Cl > F$. These results are related to the known electrochemical properties of the groups involved.

The Decomposition of Hydrogen Peroxide by Ceric Salts. II. The Reaction with Ceric Perchlorate, M. ARDON*, G. STEIN, *The Hebrew University of Jerusalem.* In part I it was shown[1] that the reaction between H_2O_2 and ceric sulphate solutions is instantaneous in the pH range 0—1.5. In the case of perchlorate solutions, where complex formation with ClO_4^- is negligible, it was found that even at pH ~ 0.8 a coloured compound is formed with H_2O_2, which decomposes only slowly. It was found that the compound is formed apparently between a ceric colloidal polymer and H_2O_2. This colloidal polymer is apparently related to the species $[Ce—O—Ce]^{4+}$. The spectra and the kinetics of the decomposition have been investigated and it was found that in spite of its colloidal nature, the compound had a fairly well defined composition of approx. 1 H_2O_2 : 2 Ce. The irreversible formation of this polymeric species at this low pH profoundly influences the spectrum and redox-potential of the solution and has great influence e.g. in photochemical processes[2]. If the polymer is once allowed to be formed at a higher pH it persists in solutions even at pH = 0. This is the case in acidified $Ce(OH)_4$ solutions. It is not formed when ceric perchlorate is produced in strongly acid solutions by electrolytic oxidation and in this case the reaction with H_2O_2 is very fast, with no discernible intermediate complex formation.

REFERENCES
1. BAER, S. and STEIN, G., 1953, *J. Chem. Soc.*, 3176.
2. STEIN, G., and WEISS, J. unpublished results.

Anion Exchange in the System Iron(3)-Chloride, Y. MARCUS, *Israel Atomic Energy Commission.* According to considerations reported in the paper of C. D. Coryell and Y. Marcus (March 1954), a detailed method for anion exchange in complex systems was developed. The system iron(3)-chloride was chosen as example, as some data on it appear in the literature (Kraus and Moore, 1952).

Detailed experiments with hydrochloric acid and lithium chloride solutions made it possible to obtain the distribution function D as depending on the iron chloride and hydrogen ion concentrations.

It was found that, for quantitative calculations, the invasion of the resin by hydrochloric acid must be considered, and suitable equations were derived. The complexity constants may be calculated from the equation:

$$d \log D / d \log [A] = \nu - n + \bar{n}\, d \log [A]R / d \log [A]$$

(where ν is the valence, $[A]$ the ligand activity, R denotes the resin, n is a coefficient and $\bar{n}$ the average ligand number).

The complexity constants calculated according to this method compare well with those appearing in the literature for the system studied, and the existence of the strong acid $HFeCl_4$ was proven. The good correlation of the constants proves the general applicability of the method.

NEWS AND VIEWS

International Symposium on Electrical Discharges in Gases

An International Symposium on Electrical Discharges in Gases will be held at the Technical University of Delft, Netherlands, from April 25th to April 30th, 1955, with the support of UNESCO, through the intermediary of the International Union of Pure and Applied Physics, the Technical University of Delft and the Philips' Works, Eindhoven.

SUBJECTS OF DISCUSSION

1. Fundamental processes and new views on the mechanism of gas discharges
2. Instabilities and conditions of stability, oscillations and noise phenomena in gas discharges
3. Breakdown potential as a function of p.d. and the frequency
4. a. New methods of measuring applied to the research of gas discharges
   b. Gas discharges applied to other physical problems as a method of measurement
5. Arc discharges
6. Spark discharges
7. Miscellaneous, a.o. Geiger-Mueller counters and ion sources.

MAIN LECTURES

Prof. H. S. W. Massey, London: Fundamental primary processes in gas discharges

Prof. L. B. Loeb, Berkeley: Field measurements in glow discharges with a refined electron beam probe and automatic recording

Ir Chr. van Geel, Delft: On the internal self-induction of gas discharges

Prof. S. C. Brown, Cambridge, U.S.A.: Breakdown in gases at microwave frequencies

Dr. M. A. Biondi, East Pittsburgh, Pa, U.S.A.: Microwave and optical techniques for gas discharges

Prof. W. Lochte-Holtgreven, Kiel: Arc discharges

Prof. J. M. Meek, Liverpool: Spark discharges.

The languages to be used are English, French and German. English will be preferred in the discussions.

Two days are reserved for excursions. A programme for ladies visiting Delft but not attending the Symposium will be arranged.

Enquiries concerning the Symposium should be addressed to the Secretary of the Symposium committee Ir A. W. van Wagensveld, Mijnbouwplein 11, Delft, Netherlands.

Survey of Current Research on the Middle East

The Middle East Institute, a private organization in Washington, D.C., is preparing for publication an annual Survey of Current Research on the Middle East. The purpose of this Survey is to provide scholars and educational institutions with information on what research has recently been completed or is now being undertaken in the field.

Definition of research: (1) accumulation of original data; (2) classification of original data; (3) interpretation of data previously accumulated; (4) reinterpretation of data previously studied; (5) translation, bibliography, vocabulary, etc. with annotation.

Geographical limits: the Arab countries, Israel, Afghanistan, Iran, Turkey, North Africa, the Sudan, Ethiopia and Eritrea.

Disciplinary limits: emphasis on the social sciences, but including all related aspects of the humanities and natural sciences.

Chronological limits: none (ancient, medieval, and modern).

All those who are currently engaged in research on the Middle East, or have completed such research since October 1, 1954, are urged to submit the following information: name, address, topic of investigation, sponsoring organization (if any), date of completion or estimated date if still in progress, and pertinent comments on the nature of the research, sources being used, and method of approach.

Please address correspondence to: Survey of Research, The Middle East Institute, 1761 N Street N. W., Washington 6, D.C.

BRAUN, E. A.

Some Investigations on the Effect of Pressure on the Luminescence of Solid, I, Bull. Res. Counc. of Israel, 1954, 4, 219.
The response to pressure of the luminescent efficiency of powdered impurity activated phosphors was compared with that of the edge emission of photographic emulsions. It was found that pressures up to 500 kg/cm2, whether hydrostatic or not, have but little effect on the luminescent efficiency of impurity activated phosphors. On the other hand, the edge emission efficiency of photographic emulsions is strongly reduced by plastic deformations.

BRAUN, E. A. and BAROUCH, A.

Some Investigations on the Effects of Pressure on the Luminescence of Solids, II, Bull. Res. Counc. of Israel, 1954, 4, 222.
Several powdered phosphors were partly destroyed by grinding, and their glow curves compared with those of the normal phosphors. This comparison gives a possible clue to the lowering of the efficiency by grinding.

AMINOFF, D.

Mucoids and their Biological Functions (Review), Bull. Res. Counc. of Israel, 1954, 4, 225.
The mucoids, as complex molecules containing hexosamines, form a rather heterogeneous group of compounds. Chemically they can be classified into the low molecular mucosaccharides and the macromolecular complexes; mucopolysaccharides, mucoproteins, mucolipids, muconucleotides and sialomucoids. According to their biological functions, the mucoids can be divided into four major categories: a) structural, b) storage, c) secretory and d) those that are specifically active. Owing to their lability and chemical complexity, detailed investigation of the constitution and structure of the pure mucoids is still lacking. Preliminary results, however, seem to indicate that the structurally active mucoids owe their activity to their physical properties; whilst, in contrast, those with a specific dynamic biological function are dependent on the chemical integrity of a definite functional group, or groups, within the molecule.

GRUENBERG-FERTIG, I.

On the Sudano-Deccanic Element in the Flora of Palestine, Bull. Res. Counc. of Israel, 1954, 4, 234.
1. The examination of distributional relations of the species recorded for the Deccan Peninsula and Ceylon showed that out of 4789 species only 27 could be considered Sudano-Deccanian or sub-Sudano-Deccanian in the sense of Eig (1931—32). This, and other considerations, led the author to separate the Sudan together with SW. Arabia from the Deccan as independent plant geographical regions.

2. Random examinations of the distribution of species belonging to genera and families strongly developed in the Sudanian region, revealed very few or no Omni-Sudanian endemics, and, on the other hand, a very large number of species endemic either to the western or to the eastern part of the region. It is, therefore, proposed to subdivide the Sudanian region into a West-Sudanian and an Eritreo-Arabian subregion.

3. The 39 Palestinian species, referred to by Eig (l.c.) as Sudano-Deccanian and sub-Sudano-Deccanian, were thus reclassed as follows: 9 Omni- and sub-Omni-Sudanian, 11 Eritreo-Arabian and sub-Eritreo-Arabian, 1 sub-South African Transitional, 2 Sudanian-Deccanian bi-regionals, 1 Sudanian-East African Steppical bi-regional, 4 Tropical African and 7 Tropical African-Indo-Malayan pluri-regionals, and 3 Tropical wides. One species, as not indigenous in Palestine, was excluded.

BOYKO, H. and TADMOR, N.

An Arid Ecotype of Dactylis glomerata *L. (Orchard grass) found in the Negev (Israel)*, Bull. Res. Counc. of Israel, 1954, 4, 241.
Dactylis glomerata L., which normally grows in more humid areas, was found in the Central Negev in a region of about 150 mm of rainfall. The actual habitat benefits from additional run-off water and the plant-sociological analysis of the vegetation shows the site to be roughly comparable to sites of 250—300 mm rainfall.

This seems to be a very drought-resistant ecotype, more so than other such ecotypes of this valuable fodder grass so far investigated.

SOBEL, H.

The Effects of Cortisone and Growth Hormone on the Embryonic Chick Pituitary Grafted to the Chorio-Allantoic Membrane, Bull. Res. Counc. of Israel, 1954, 4, 249.
Pituitary rudiments of 6-day chick embryos were grafted on the chorio-allantoic membrane of 8-day embryos. In untreated grafts broad strands of the host's connective tissue, rich in blood capillaries, penetrated the grafted epithelial tissue. The infiltration process and the inflammatory reaction of the host tissues resulted in a small number of takes and retarded development of the glandular tissue.

Administration of cortisone in a single injection of 1 mg resulted in a greater number of takes due to the retarded and scarce infiltration of the graft by the host tissue and a negligible inflammatory reaction. This influence of cortisone brought about a derangement of the quantitative relationship between the connective and epithelial tissues in the graft and affected unfavourably the differentiation of the chromophilic cells.

Treatment of the cortisone injected grafts with daily injections of growth hormone increased the amount of connective tissue resulting in a relationship between the epithelial and connective tissues similar to that found in normal developing glands of corresponding age. In grafts treated both with cortisone and growth hormone an early differentiation of acidophil cells took place.

MOSCONA, ARON

Seasonal Changes in the Islets of Langerhans in Snakes, Bull. Res. Counc. of Israel, 1954, 4, 253.
A seasonal, reversible hypertrophy of the endocrine tissue in the pancreas of female snakes is described. Possible correlations between these changes, the sequence of the reproductive cycle and ovarian activity are discussed.

MAVROMOUSTAKIS, G. A.

New and Interesting Bees (Hymenoptera, Apoidea) from Israel, Bull. Res. Counc. of Israel, 1954, 4, 256.
Description of new genera: *Oxybiastes* Mavr. (genotype: *O. bischoffi* Mavr. sp. nov.) and *Bytinskia* Mavr. (genotype: *B. erythrogastra* Mavr. sp. nov.) and new species: *Ammobates constrictus* Mavr.; *Ammobates bytinskii* Mavr.; *Osmia leiocephala* Mavr.; *O. verhoeffi* Mavr.; *O. paralias* Mavr.; *Dioxys ammobius* Mavr.; *Prodioxys richardsi* Mavr.; *Stelis wahrmanni* Mavr. 1949=*O sordita* Ben. 1929; *O. sordita* Mavr. 1949 (nec Ben. 1929)=*Bytinskia erythogastra* Mavr. New records for Erez Israel: *Exoneura libanensis* Friese, *Ammobates niveatus* Spin., *Osmia singularis* Moraw., *O. latipes* Moraw. *var.*

HILLE RIS LAMBERS, D.

New Israel Aphids, Bull. Res. Counc. of Israel, 1954, 4, 276.
In material sent to Dr. Hille Ris Lambers for identification the following new species of aphids were found which had not yet been described: *Ctenocallis israelica, Lachnus swirskii, Paracletus subnudus, Chaitophorus minutus*. Also the species *Paczoskia turanica* is new for Israel. Descriptions are given.

BYTINSKI-SALZ, H.

Insects associated with Desert Acacias in Israel, Bull. Res. Counc. of Israel, 1954, 4, 284.
50 species of insects (of them 31 new to the fauna of Israel) are enumerated as being ecologically associated with *Acacia raddiana* and *A. spirocarpa*. The majority of the species (74%) show paleotropic, especially Ethiopian affinities, while the rest are of Mediterranean, Saharo-Sindian or of endemic origin. Of the wood borer complex (19 species incl. predators and parasites) all are species of Ethiopian affinities. 97% of the paleotropic species are monophagous on *Acacia*, while all of the Mediterranean and Saharo-Sindian species are polyphagous. The immigration of the species from Ethiopia occurred in several waves from the middle Tertiary till the late Pleistocene along the Red Sea coast. Half of the species of paleotropic origin are not known to occur in Egypt, which suggests an immigration via Arabia.

COSTA, M.

On a Collection of Fleas from Microtus Guentheri, Bull. Res. Counc. of Israel, 1954, 4, 293.
A collection of fleas from *Microtus guentheri* was found to consist of 2 species, *Ctenophthalmus congener* and *Neosopsyllus* (?) *sincerus*. The seasonal distribution and the sex ratio of these species was studied.

HAGIN, J.

Water Stability of CRD-186 Treated Soils, as Influenced by Leaching, Bull. Res. Counc. of Israel, 1954, 4, 297.
To a coarse textured soil, from Rehovot, and to a fine textured one, from Ramat David, a solution of CRD-186 (a VAMA type soil conditioner) was applied, and the samples were leached subsequently by various salt solutions.

According to water-stable aggregate analyses performed, the leaching did not induce changes in the water stability of the soil aggregates.

It was concluded, that the results tend to confirm that bonds between soil particles and polymer molecules are not of an ion exchange character.

GUTSTEIN, J.

The Effect of Israeli Climatic Conditions and Soils upon the Free and Total β-Amylase of Three Varieties of Barley, Bull. Res Counc. of Israel, 1954, 4, 300.

Three varieties of six rowed barley were sown at four localities during two growing seasons: 1945 —46 and 1946—47. The two seasons differed mainly in the amount of rain and its distribution.

It is shown that the smount of free and total ^{4}-amylase is a varietal characteristic, but that it is also affected to a very large extent by soil and climatic conditions. The amount of rain, and mainly its distribution over the growing season, causes large variations in the amount of free and total ^{4}-amylase. Inadequate moisture supply, mainly during the ear and kernel development, causes a raise in the amount of the total ^{4}-amylase from 346.9 malt. equi. (1945—46) to 507 malt. equi. (1946—47). This rise in the amoint of total ^{4}-amylase is relative only, because if it is expressed in grams maltose in 1000 kernels it is almost equal in both seasons: 221.46 and 227.4 maltose.

The effect of moisture availability during the different stages of development of the barley plant on the relative variations in the amount of ^{4}-amylase is also explained.

There is a very significant negative correlation between the amount of ^{4}-amylase and starch in the barley kernel.

א. בראון, חקירות על השפעת הלחץ על לומינסצנטיה של מוצקים. I 219

נעשתה השוואה בין השפעת הלחץ על הנצולת הלומינסצנטית של פוספורים טחונים לבין פליטת האמולסיות הפוטוגרפיות. התברר שלחצים עד 500 kg/cm^2, בין אם הידרוסטטיים ובין אם לאו, כמעט ואינם משפיעים על הנצולת של פוספורים עם אקטיבטור. מצד שני, הנצולת של פליטת האמולסיות הפוטוגרפיות יורדת באופן ניכר ע"י עבודים פלסטיים.

א. בראון וא. ברוך, חקירות על השפעת הלחץ על לומינסצנטיה של מוצקים. II 222

נעשתה השוואה בין עקומות הלהט של פוספורים טחונים ופוספורים נורמליים (כל הפוספורים הין בצורת אבקה). השוואה זו נותנת הסבר אפשרי של ירידת הנצולת ע"י טחינה.

ד. אמינוף, המוקואידים ותפקידיהם הביולוגיים 225

אירנה גרינברג־פרטיג, הערות על האלמנט ה"סודנו־דקני" בצמחית הארץ 234

נברקו הייחסים הפלורסטטיים בין החטיבות השונות הכלולות בתוך האזור ה"סודנו־דקני" של איג (1931). בדיקה סטטיסטית של התפוצה הגיאוגרפית של 4789 המינים המצויים בחצי האי הדקני ובצילון הראתה כי רק 27 מינים משותפים ומונבלים לחטיבות הדקנית והסודנית (האחרונה כוללת את החלק הדרום־מערבי של חצי האי הערבי), לעומת 636 מינים המונבלים לשני חצאי־האי הנזכרים (מגלי לקחת בחשבון את המינים האנדמיים לדקן ולצילון).

הוסק כי יש להפריד את החטיבות הנ"ל לאזורים פיטוגיאוגרפיים עצמאיים, האזור הסודני (עם ערב דרומית־מערבית) והאזור שלפי שעה יקרא דקני.

כמו כן נברקה באופן סטטיסטי תפוצת מינים השייכים לסוגים בעלי התפתחות חזקה באזור הסודני. התברר כי בכל סוג וסוג אין, או ישנם רק מינים מועטים אנדמיים לכל האזור הסודני, בעוד שנמצאו מינים רבים שהם אנדמיים או לחלקו המערבי או לחלקו המזרחי של האזור. הוצע על כן לפי שעה לחלק את האזור הסודני לתת־אזורים: המערבי־סודני והמזרחי־טריאו־ערבי.

בהתאם למסקנות הנ"ל נבדקה מחדש תפוצת 39 המינים שצוטטו על ידי איג כסודנו־דקניים או סוב־סודנו־דקניים, והם מוינו עתה כדלהלן: 9 כלל או סוב־כלל סודניים, 11 ארי־סטריאו־ערביים, 1 סוב מעבר דרום־אפריקני, 2 דו־אזוריים סודנו־דקניים, 1 דו־אזורי סודנו — מזרח אפריקני ערבתי, 7 רב־אזוריים, ביניהם 4 טרופיקו־אפריקניים ו־3 טרופיקו־אפריקניים־אינדו־מלאיים, ולבסוף 3 מינים בעלי תפוצה טרופית כללית. מין אחד שהוא אינו אינדיגני בארץ, לא נידון פה.

ה. בויקו וג. תדמור, אקוטיים צחיחי של *Dactylis glomerata* L. הנמצא בנגב 241

דבורת ההרים, אשר תפוצתה בדרך כלל באזורים יותר לחים, נמצאה בנגב באזור של 150 מ"מ גשם. בית הגידול המשני נתגה אפנם מתוספת מי זריעה עלית, ואנליזה פיטוסוציולוגית של הצומח מראה שבבית הגידול שוררים תנאים המצויים בדרך כלל באזור של 250 עד 300 מ"מ גשם. דבורת ההרים כאן שייכת לאיקוטים עמיד מאד בפני יובש, יותר מאשר טיפוסים אחרים שהושוו.

סובל, ה. השפעת קורטיזון והורמון הגידול על היפופיזים של עובר תרנגול שהורכבה על הממברנה הכוריו־אלנטואידית .. 249

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תוספת של קורטיזון (Cortisone, 1 mg.) מעכבת במידה רבה את ההתחדרה ואת הדלקת של רקמות המאכסן וכתוצאה מתקבלים הגרפטים ביתר קלות. אך יחד עם זאת מפריע הקורטיזון במידה מסויימת את הדיפרנציאציה של רקמת ההיפו־פיזים. ע"י הוספה של זריקות יומיות של הורמון־הגדול (growth hormone) נתבטלה ההשפעה של הקורטיזון על הגרפט, ובטיפול כפול זה מתקבלים גרפטים המראים יחס פרופורציונאלי בין רקמות החבור והאפיטל אפיני להיפופיזים עוברית נורמלית בגיל המתאים. כמו כן עוברת הרקמה של הגרפט את הדיפרנציאציה לרקמה בלוטית עם תאים סקרטוריים אפיניים, בעקר אצידופילים.

א. מוסקונה, שינויים עונתיים ברקמה האנדוקרינית של הסנקריאס (איי לנגרהנס) בנחשים 253

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אסף של פרעושים מנברן השדה *Microtus guentheri* נבדק. נמצאו בו שני מיני פרעושים *Ctenophthalmus congener* ו־*Neosopsyllus* (?) *sinceri*. התפוצה העונתית ויחס המינים של המינים הנ"ל נחקרו.

ו. הגין, השפעת השטיפה על היציבות כמים של קרקעות שקיבלו טיפול בחומר משפר מבנה 297

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המסקנות שאפשר להסיק מהעבודה מתאימות לאלה שהוסקו במקום אחר. נראה שאין הקשרים בין חלקיקי הקרקע למוקולות של הפוליטר באים הדדית לחילוף יונים.

נוסף לזה הראו תוצאות העבודה שערוב הקרקעות לאחר הוספת החומר והמים מעלה את הכמות והיציבות במים של תלכידי הקרקע.

ז. גומשליין, השפעת טיפוסי קרקע ותנאים אקלימיים בישראל על מתכונת ה־β – עמילוזה החפשית והכללית בשלשה זני שעורה 300

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נמצא שמתכונה ה־ עמילוזה החפשית והכללית היא תכונה אופינית לזן; אולם היא מושפעת במידה רבה ע"י התנאים האקלימיים והקרקעיים. כמות הגשמים העונתית ובעיקר אופן חלוקתם גורמת לתנודות גדולות במתכונת ה־ עמילוזה החפשית והכללית, תנאי יובש, בעיקר בעת התפתחותה של השבולת והגרגיר מעלים את מתכונת ה־ עמילוזה, מ־9.46 מלטוזה אקוויולנס עמילוזה כללית בעונת 46—1945 הגשומה יותר ל־507 מלטוזה אקוויולנט בעונת 47—1946 השחונה. עליה זו במתכונת ה־ עמילוזה הכללית היא יחסית בלבד; אם מבטאים אותה בגרם מלטוזה ל־1000 גרגירים היא שוה כמעט בשתי העונות; 221.46 ו־227.4 גרם מלטוזה, ניתן הסבר על התנודות היחסיות במתכונת ה־ עמילוזה הגרמות עקב התנודות בזמינות המים לצמחים בתקופות שונות של התפתחותם.

קיים יחס הפוך בולט בין מתכונת ה־ עמילוזה ומתכונת העמילן בגרגיר השעורה.

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THE ECOLOGY AND TAXONOMY OF THE APHIDOIDEA OF THE MIDDLE EAST by F. S. BODENHEIMER and E. SWIRSKI, The Hebrew University of Jerusalem.

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